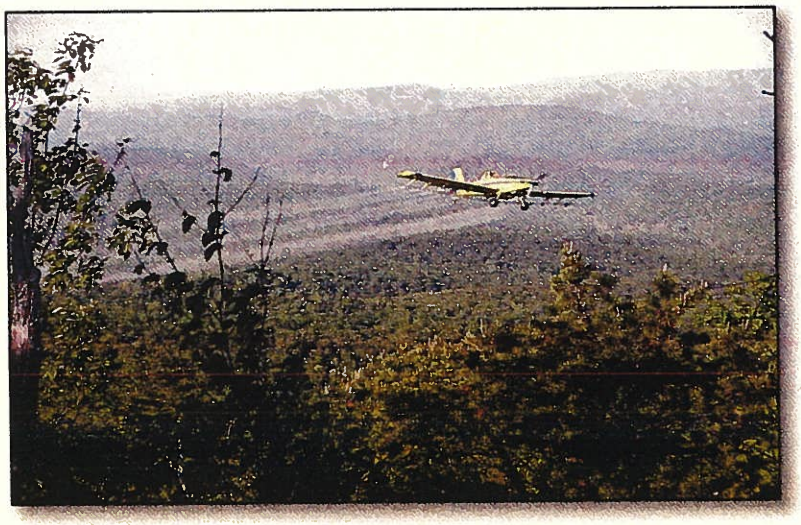
Environmental Assessment
2009 Gypsy Moth Suppression Project

Gypsy Moth Treatments Proposed on the Marlinton/White Sulphur Ranger District in Greenbrier and Pocahontas Counties

Monongahela National Forest
State of West Virginia

February 2009



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CHAPTER 1 - PURPOSE AND NEED FOR ACTION

1.1 Proposed Action

The Forest Service proposes to treat an estimated 13,140 acres of National Forest System lands in 12 separate treatment blocks for the control of gypsy moth (Table 2.1). These suppression treatments would consist of the following: one aerial application of the bacterial insecticide *Bacillus thuringiensis* var. *kurstaki* (*Btk*) on 5,224 acres; two applications of *Btk* on 7,445 acres; and two applications of Gypchek, the gypsy moth specific biological insecticide, on 471 acres. Treatments would be applied using a host of mitigation measures and environmental constraints that are described in Chapter 2 of this Environmental Assessment (EA). The proposed treatment area is located on the Marlinton/White Sulphur Ranger District of the Monongahela National Forest, in Greenbrier and Pocahontas Counties. Treatments would occur during a two-week period in the spring of 2009. The exact dates would depend on the progress of leaf growth and gypsy moth larval development. The public would be notified when the spraying would take place through multiple methods, including news media, website posting, and on-site signing. A detailed map of the proposed treatment areas is in Chapter 2. For more detailed information, please see the description of Alternative 2, the Proposed Action, in Chapter 2 of this EA.

1.2 Need for Action

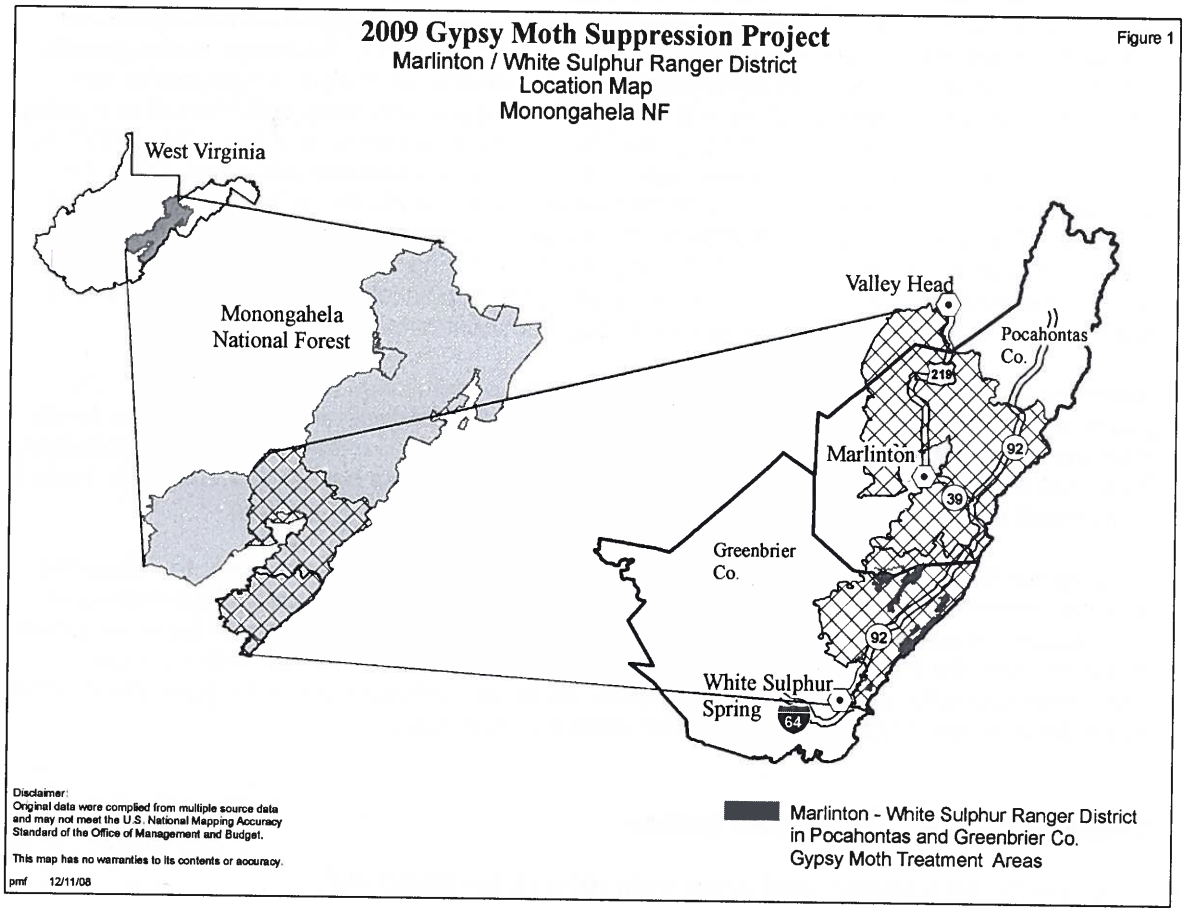
1.2.1 Background of the Gypsy Moth

The gypsy moth, *Lymantria dispar* (Linneaus) is a non-native defoliator of forest, shade and ornamental trees throughout the northeastern United States. Since its intentional importation and accidental release in eastern Massachusetts in 1869, the gypsy moth has steadily expanded its range. Despite many attempts to halt its spread westward from the northeastern United States, West Virginia experienced its first gypsy moth defoliation in 1985. Since that time, the gypsy moth has defoliated an estimated 2.4 million acres within West Virginia.

The gypsy moth produces one generation per year. Larvae begin hatching from egg masses in late April and early May when tree buds begin to open. At this time, larvae go through an obligatory dispersal period where they leave the vicinity of the egg, moving upward and spinning a thread of silk as they go (Leonard 1981). Eventually the wind catches the larvae and disperses them. Airborne larvae are carried and deposited some distance downwind from the source with the following results: 1) larvae will land on or crawl onto acceptable host plants and begin feeding; 2) larvae will land on either acceptable or unacceptable host plants and re-disperse; 3) larvae will be deposited into areas unacceptable for survival and re-dispersal where they will die (Mason and McManus 1981). The larvae feed for two to three months, completing their development by late June and early July, and seek sheltered areas in which to pupate. The pupal period lasts anywhere from 10 days to two weeks. After emerging from the pupal case the females, which cannot fly, crawl a short distance and emit a pheromone scent to attract males. After mating, the female lays a single egg mass that contains from 75 to 1,000 eggs, which she covers with hairs from her abdomen giving the egg mass a fuzzy brown texture and color. The egg masses over winter and hatch the following spring.

The number of host trees and shrubs fed on by the gypsy moth exceeds 300 species, with species of oaks (*Quercus* spp.) ranked among the most favored (Leonard 1981). Gypsy moth is an outbreak species whose populations can remain at low levels for several years, then undergo large population increases in a matter of one or two years. After populations have increased to an outbreak density they can remain high for one to five years.

Figure 1.1. Location Map for the 2009 Gypsy Moth Suppression


2009 Gypsy Moth Suppression Project
Marlinton / White Sulphur Ranger District
Location Map
Monongahela NF
Figure 1
West Virginia
Monongahela National Forest
Valley Head
Pocahontas Co.
219
Marlinton
92
39
Greenbrier Co.
92
White Sulphur Spring
64
Disclaimer:
Original data were compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget.
This map has no warranties to its contents or accuracy.
pmf 12/11/08
Marlinton - White Sulphur Ranger District in Pocahontas and Greenbrier Co. Gypsy Moth Treatment Areas

Outbreaks decline suddenly to low densities where it is difficult to find any life stage (Liebhold *et al.* 2000). The main effects of gypsy moth feeding on individual trees involves the depletion of root carbohydrate food resources leading to a reduction in growth, reproduction, and increased vulnerability to secondary agents of mortality. Heavy defoliation forces re-foliation that occurs when about 60 percent of the foliage is lost (Liebhold *et al.* 1994). This re-foliation uses carbohydrate reserves in trees and can increase their vulnerability to other environmental stresses such as drought, fire, acid deposition, and other insects and diseases. This defoliation and subsequent tree mortality can alter wildlife habitats, change water quality and temperature, increase forest floor temperatures and light levels and reduce aesthetic, recreational, and property values of forests and urban environments.

1.2.3 Current Situation and Purpose and Need for Action

During the summer of 2008, aerial surveys performed by the Forest Service and the State of West Virginia identified 23,419 acres of forest defoliated by the gypsy moth within the Monongahela National Forest proclamation boundary. This is a dramatic increase from the 7,811 and 724 acres mapped in 2007 and 2006, respectively. Many of the areas defoliated in 2008 also experienced some level of defoliation in 2007. In a hardwood forest, about 30 percent of the

leaves must be eaten for the defoliation to become noticeable during an aerial survey (primary detection technique). Studies of defoliation impacts have shown that growth loss begins when defoliation reaches about 40 percent and re-foliation at about 60 percent (Liebhold *et al.* 1994). High gypsy moth populations in the proposed treatment areas, in combination with dry spring conditions, might result in another defoliation event that could lead to reductions in tree growth, reproduction (flowering and seed production), or tree mortality, all of which could conflict with existing resource management objectives. Results of tree mortality were documented in a gypsy moth mortality study conducted in 2005 by the West Virginia Department of Agriculture (WVDA). An estimated 56,602 acres were heavily defoliated 2 of 3 years between 2000 and 2002. The estimated value for timber killed on the 56,602 acres was $18.8 million for both sawtimber and pulpwood. The actual dollar value of the timber killed was much greater because significant mortality was documented in stands defoliated only once during the 3-year period. Thus, the need for this action is generated from recent gypsy moth population increases and the impacts those populations could have on Forest resources if not controlled.

Treatment areas were determined from aerial detection of defoliation and subsequent on-the-ground moth egg mass surveys. Areas prioritized for treatment generally have egg mass levels measured in thousands per acre, and many have experienced more than one year of defoliation. Given that over 13,000 acres would be treated and each egg mass has up to 1,000 eggs, there is the potential for billions of gypsy moth larvae feeding in these areas this spring.

The purpose for the proposed action is to prevent gypsy moth defoliation in order to reduce the aesthetic, economic, and environmental impacts caused by gypsy moth caterpillars feeding in these specific areas, while minimizing any adverse impacts of the treatments on the environment. Personnel from the Forest Service would select a treatment time to coincide with the most susceptible caterpillar stages of the gypsy moth. An aerial contractor under the supervision of the Forest Service and WVDA personnel would apply the insecticide.

1.3 Objectives of the Proposed Action

The objectives for the proposed 2009 gypsy moth suppression project are:

1. To reduce gypsy moth populations to avoid third-year defoliation in the project area in order to avoid large-scale tree mortality; which would reduce timber value and wildlife habitat quality, including hard mast production.

2. To reduce threats of gypsy moth defoliation to recreational opportunities and values in the project area.

3. To reduce the impacts of gypsy moth defoliation on non-target species (species other than gypsy moth that may potentially be affected by proposed treatments).

By implementing the proposed action, we expect to limit individual crown defoliation to 30 percent or less with the use of Gypchek and/or *Btk* and to reduce gypsy moth populations so that treatment will not be needed the following year. These treatment objectives would be evaluated by aerial defoliation surveys and post-treatment egg mass surveys, respectively.

1.4 Relationship to Other Decisions

This EA is associated with other environmental impact statements and assessments. To understand the significance of this EA, it is necessary to review this relationship. When taken together, these documents provide for a better understanding of long-term and cumulative environmental impacts.

1.4.1 1995 Final Environmental Impact Statement

In late 1995, the USDA issued a new programmatic Final Environmental Impact Statement (FEIS) entitled, "Gypsy Moth Management in the United States: a Cooperative Approach" (USDA, 1995). Pursuant to the National Environmental Policy Act (NEPA), a Record of Decision (ROD) was signed in January of 1996. The alternative selected in the ROD included all three of the gypsy moth management strategies analyzed in the FEIS--suppression, eradication, and slow the spread. NEPA demands that implementation of this alternative be preceded by a site-specific analysis (the environmental assessment) that addresses local issues. This EA provides the site-specific analysis as required by the ROD, and it is tiered to the programmatic FEIS.

The purpose of tiering is to eliminate repetitive discussions of the issues addressed in the FEIS (40 CFR, 1502.20 and 1508.28 in Council on Environmental Quality 1992). Throughout this EA, many references to material in the FEIS may be used. This tiering allows the EA to focus on issues specific to the action proposed by the Forest Service.

The FEIS allows federally funded suppression projects to use the integrated pest management (IPM) approach, if site-specific analysis indicates the need to do so. IPM includes such possible activities as spraying with chemical and biological insecticides, releasing gypsy moth predators and parasites, trapping gypsy moths using attractant chemicals, and changing forest stand composition.

The Forest Service has chosen not to consider the non-insecticidal components of IPM in the preparation of this EA. These methods are not an effective means to suppress high insect populations such as those documented in the proposed treatment areas, and would therefore not meet project objectives. As stated in this EA, the Forest Service proposes the use of *Btk* and Gypchek to suppress gypsy moth in the proposed treatment area.

The FEIS also provides (1) standard operating procedures for spray projects and associated public involvement activities, and (2) an analysis of potential environmental and human health-related effects. A copy of the FEIS is available upon request from the Forest Service office listed on the title page of this EA.

This EA fulfills the site-specific planning necessary for the proposed 2009 suppression project and provides the Forest Service with the necessary project-level information for making a decision on the proposed action.

1.4.2 Monongahela National Forest Land and Resource Management Plan (Forest Plan)

This EA is also tiered to, and consistent with the 2006 Forest Plan, specifically Forest-wide management direction for treatment of non-native pests found on page II-20, and Management Prescription (MP) area Guidelines 5135 (p. III-30) and 8004 (p. III-49), and Standard 6202 (p. III-43), which allow treatments to help control insect or disease outbreaks in areas that do not typically feature vegetation management.

All MP areas included in this proposal allow for treatment of non-native pests. The Spice Run area, south of Calvin Price State Forest, is listed as an MP 6.2 area. Currently there is a proposal to designate this area as Wilderness, MP 5.0. Congressional action is needed to make this change. If this change is made, treatment for non-native pests is allowed in Wilderness according to Guideline 5037 and Standard 5038 on page III-32 of the Forest Plan.

1.5 Decision to Be Made

The Forest Supervisor will make a decision based on this EA and supporting documentation. He will decide whether or not action is warranted. If it is, he will decide whether to implement the proposed action to suppress gypsy moth populations or some alternative to this proposed action.

The responsible official will make these decisions on or about February 19, 2009 to ensure timely funding for an effective gypsy moth suppression project that meets the Forest Service's objectives. The responsible official is:

Clyde Thompson, Forest Supervisor
Monongahela National Forest
200 Sycamore Street
Elkins, WV 26241

1.6 Public Involvement and Issues

NEPA requires public involvement and notification for all projects utilizing Federal funds (40 CFR, 1506.6 in Council on Environmental Quality 1992). Procedures outlined in this section address the Forest's compliance with those requirements.

1.6.1 Summary of Public Involvement and Notification Process

A variety of individuals and organizations were contacted to determine the scope of the issues and concerns related to the proposed action. On September 9, 2008, a letter describing the proposed action was mailed to 77 local landowners, interested citizens, organizations, government agencies and media sources. Recipients of the letter were asked to provide comment specific to the proposal by October 10, 2008. Two other people were contacted by e-mail, as per their request. A news release regarding this proposal was sent to the Pocahontas Times, Beckley Register Herald, and Charleston Gazette on September 11, 2008. Initial comments were received from 8 sources (3 individuals, 2 organizations, and 3 state agencies). The initial scoping effort and public responses are documented in the 2009 Gypsy Moth Suppression Project File.

1.6.2 Issues Considered in Detail

Public and internal comments were analyzed to identify the significant issues related to the proposal (see project file). The identification of significant issues was done with careful consideration to the scope of the proposed action, and to the extent, duration and intensity of the issue. Significant issues were defined as those directly or indirectly caused by implementing or not implementing the proposed action. The issues listed below guide the analysis in the Environmental Consequences section of this EA.

Issue 1 – Effects of gypsy moth defoliation on timber resources

Changes in tree species diversity, age class distribution, and general health and vigor are affected by gypsy moth defoliation. Heavy feeding causes defoliation, which weakens trees and increases their vulnerability to other insects and diseases that may kill them. After two successive years of defoliation, hardwood tree mortality may be expected, especially if combined with drought conditions during the summer months.

Issue 2 - Effects of gypsy moth *Btk* treatments on non-target organisms

Concerns under this issue are effects on (1) threatened, endangered, or sensitive species, and (2) other moths and butterflies.

Issue 3 – Effects of gypsy moth defoliation and treatments on soil and water resources

The potential impacts to soil characteristics and water quality from gypsy moth defoliation and treatments are of concern.

Issue 4 – Effects of gypsy moth defoliation and treatments on recreation and scenic resources

Impacts to visual quality and recreation opportunities from defoliation and tree mortality are a concern, particularly along travel corridors such as roads, recreation trails, and overlooks.

1.6.3 Issues Not Considered in Detail

The following issues were raised during scoping for this EA. They are summarized here, with an explanation of how they have been addressed.

Issue: Human health risks associated with aerial spraying of *Btk* and Gypchek

Btk

This issue was eliminated from detailed study because an extensive analysis, available in the Human Health Risk Assessment of the FEIS, has determined that *Btk* is nontoxic to humans and it is highly unlikely to pose a hazard to human health when properly applied (USDA, 1995, Vol. III, pp. 4-1 to 4-21). *Btk* is a naturally-occurring bacterium that has insecticidal activity against gypsy moth and other Lepidoptera (moths and butterflies).

Persons handling and loading the insecticide would be the most likely to experience any effects, which could consist of minor irritation of the skin, eyes or respiratory tract. Persons loading and handling concentrated *Btk* are required to read and follow all label precautions. Public and handler exposure would be minimized by adherence to standard human health precautions (see page 11). Based on the available epidemiological studies and the long history of its use, there is no evidence that the application of *Btk* formulations causes adverse effects in the general public (USDA 1995, Vol. III, p. 4-15).

Gypchek

This issue was eliminated from detailed study because Gypchek is a naturally-occurring virus that has insecticidal activity against only the gypsy moth. As with *Btk*, it is nontoxic to humans and it is highly unlikely to pose a hazard to human health when properly applied (USDA 1995, Vol. III. Pp. 5-1 to 5-12).

Irritation of the eyes, skin, and respiratory tract is possible from the exposure to Gypchek. Because Gypchek contains gypsy moth parts, irritant effects might be similar to those caused by the gypsy moth itself. Individuals with allergies may be at greater risk of developing irritation. Workers would be more likely affected than the general public because their exposure would be higher (USDA 1995, Vol. 1, p. 21).

Issue: Use of Diflubenzuron (Dimilin)

Dimilin is an effective treatment for all population densities of gypsy moth but it can have impacts on non-target species (i.e., aquatic organisms and other insects). Because other treatments that have fewer non-target impacts would meet the project objectives, the use of Dimilin was not considered for this proposal.

CHAPTER 2 - ALTERNATIVES CONSIDERED

The Forest Service considered different alternatives within the suppression management strategy, including no action, for meeting the 2009 suppression project objectives. These alternatives were considered to address the issues and concerns described in Chapter 1.

2.1 Alternatives Not Analyzed In Detail

One additional action alternative was considered to meet the objectives of this project. Although this alternative contributed to the reasonable range of alternatives considered for this project, it was not analyzed in detail for the reasons explained below.

2.1.1. Large-scale Use of Gypchek

Gypchek is a naturally occurring virus that has insecticidal activity against only the gypsy moth and does not affect any other organisms. Exclusive use of this control strategy is not operationally feasible for a large suppression project such as the one being proposed. Gypchek is difficult and time-consuming to produce, and there is currently only one manufacturer (the Forest Service). Therefore, only a small quantity of Gypchek is produced each year, enough for about 10,000 acres of application on gypsy moth projects nationwide. Additional gypsy moth spraying is being planned for West Virginia and Virginia in 2009, and other states may have a need for Gypchek as well. There is simply not enough supply of this insecticide to meet the nationwide demand. Therefore, the use of Gypchek in this project will likely be limited to the most sensitive areas of application, such as habitat for rare moth or butterfly species that may be affected by *Btk*.

2.2 Alternatives Analyzed In Detail

This EA analyzes two alternatives in detail:

1. No Action by the Forest Service to treat gypsy moth
2. Proposed Action - The Forest Service would suppress gypsy moth populations through aerial spraying of *Btk* and Gypchek

2.2.1 Alternative 1 - No Action

In this alternative the Forest Service would not treat gypsy moth populations in the areas proposed for treatment under the Proposed Action. Because no treatments would occur, no mitigation measures or human health precautions related to gypsy moth treatment (see measures described below under the Proposed Action) would occur either. More importantly, there would be no effects to current gypsy moth populations from treatments, as treatments would not occur.

2.2.2 Alternative 2 - The Proposed Action

In this alternative an estimated 13,140 acres are planned for treatment during the spring of 2009. The proposed treatments would consist of a single application of *Btk* on an estimated 5,224 acres; two applications of *Btk* on 7,445 acres; and two applications of Gypchek on 471 acres (see Figure 2.1 and Table 2.1). These treatments would be designed to suppress a large portion of the current gypsy moth populations within the treatment areas.

Figure 2.1 Gypsy Moth Treatment Areas for the Proposed Action

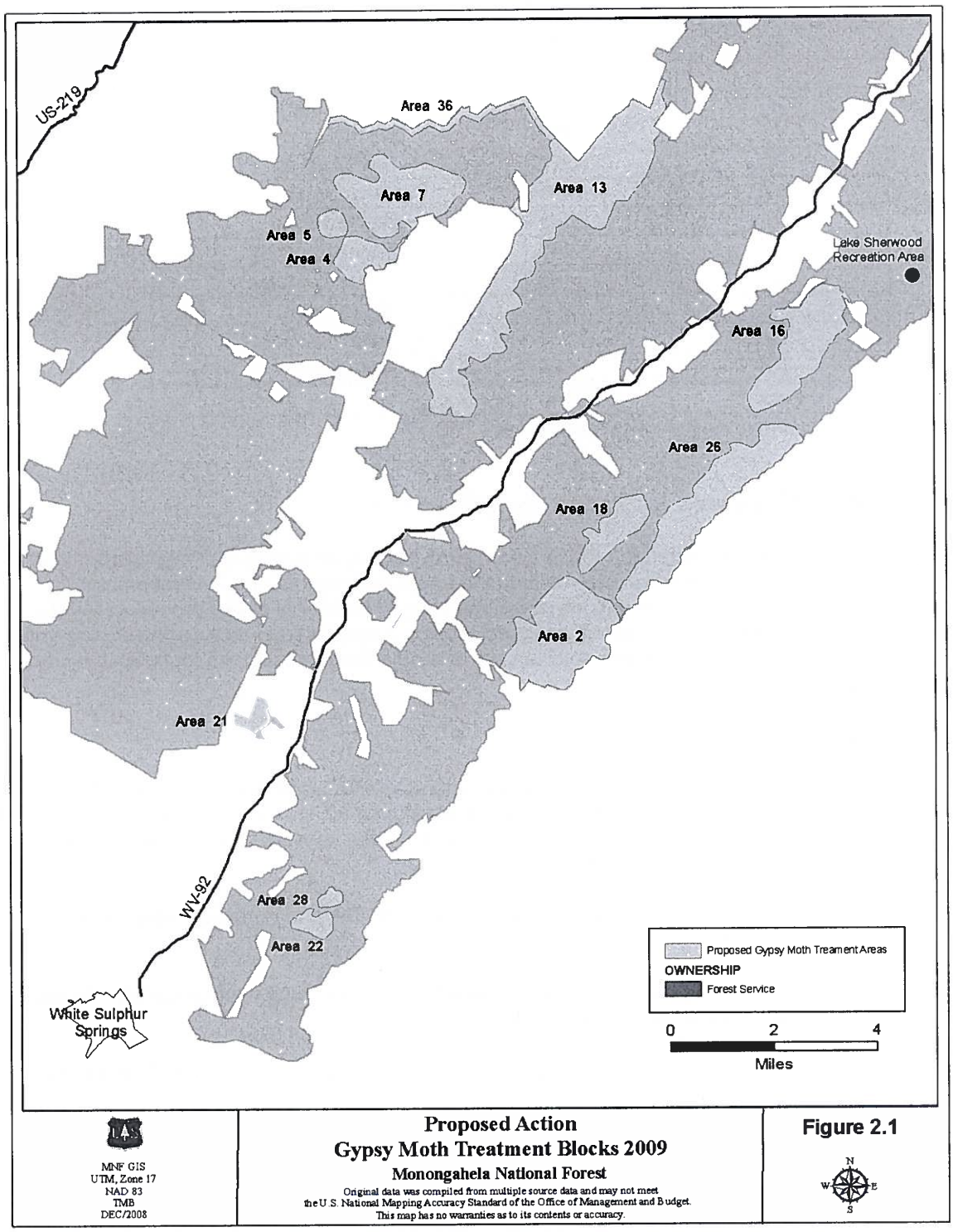


Table 2.1 Gypsy Moth Treatment Areas and Acreages for the Proposed Action

Treatment Area	Acres	Insecticide (Applications)
2	1972	*Btk*[1] (double)
4	446	*Btk*[1] (single)
5	160	*Btk*[1] (single)
7	1482	*Btk*[1] (double)
13	4220	*Btk*[1] (single)
16	1425	*Btk*[1] (double)
18	598	*Btk*[1] (double)
21	190	*Gypchek* (double)
22	198	*Gypchek* (double)
26	1968	*Btk*[1] (double)
28	83	*Gypchek* (double)
36	398	*Btk*[1] (single)
Total	13,140	

[1] *B.t.k (Bacillus thuringiensis* variety *kurstaki)*

2.3 Mitigation Measures for the Proposed Action

Mitigation measures are designed to reduce adverse environmental effects that might result from conducting the treatment activities. They include the application constraints, environmental constraints, and human health precautions described below. Additional safety procedures and guidelines related to aerial application of the insecticides are presented in an Aviation Management Plan. Copies of the Aviation Management Plan are available from the address found on the cover page of this EA.

2.3.1 Application Constraints

By establishing operational and environmental parameters for aerial application, a safe, consistent, and effective spraying project can be developed which minimizes adverse non-target effects and still gives the desired results. To achieve a safe, consistent, and effective spraying project, the following would be done:

- A private aerial contractor under the supervision of WVDA and Forest Service personnel would conduct pesticide spraying.
- Personnel from the Forest Service would select a treatment time to coincide with the most vulnerable larval stages of the gypsy moth.
- Forest Service personnel would ensure that application equipment is carefully checked and calibrated prior to treatment.
- Field personnel would be present in spray blocks during treatment for on-site monitoring and data collection.
- Field personnel would have radio contact with airport operations to advise the project supervisor on block conditions including spray status, weather, foliage expansion, and caterpillar development.
- Several environmental parameters have been set to help ensure proper spray conditions exist within each spray site when the insecticide is applied:

1. Wind speeds must be 7 mph or less when measured in an open area within or near the spray block.
2. Inversion conditions that produce ground fog or suspended spray must not be present.
3. Air temperature should not exceed 80 degrees, and humidity should not fall to a point where evaporation of the insecticide would occur before it reaches the target area. This would normally occur when relative humidity drops below 50 percent for undiluted *Btk* and Gypchek.
4. Foliage must not be dripping wet.
5. No rain must be expected within 4 hours of spraying.
6. Spraying must be confined to daylight hours beginning at dawn only when other operational conditions are acceptable.

- All treatment areas would be delineated on 7-1/2 minute USGS topographic quadrangle maps to give up-to-date information about forest cover, elevation contours, bodies of water, and man-made structures such as roads, buildings and power lines.
- Hazards to aircraft operations at spraying altitude would be identified and clearly marked on maps.
- A reconnaissance flight would be made of every site before spraying commences.
- All spray blocks would be digitized for the contractor to make use of DGPS, ensuring the most accurate application as possible.
- Communications would be maintained among the loading site, pilot and field crews at the spray sites with mobile and portable AM & FM two-way radios and cellular phones.

2.3.2 Environmental Constraints

- Application would be done over forested areas only.
- No applications would be made over large open bodies of water, such as lakes or rivers.
- Pilots would be instructed not to fly over large bodies of water if they can be safely avoided.
- Consultation with the US Fish and Wildlife Service would be done to determine if the proposed treatments would affect any known federally listed threatened and endangered species within or near the treatment areas.

2.3.3 Human Health Precautions

Several precautions are used in the program to minimize exposure to the people working on the program and those in the treatment areas. Whenever possible, areas would be sprayed early in the morning to minimize human exposure.

- In cooperation with WVDA, the Forest Service would provide preliminary public notification about the proposed treatment through radio and television news releases.
- News releases would be made 30 days prior to the tentative treatment start date.
- Local radio and television stations and other news media would be asked to release this information one week prior to treatment date.
- At the time of treatment, daily notification would be given to the media and police. Information supplied would include areas to be sprayed, the approximate time spraying would take place, and the number and type of aircraft in each area.
- A telephone system would be set up at operation headquarters with the number released to the public.
- Signs would be posted at campgrounds, and trailheads to alert visitors of spraying activity.
- At the loading site, standard pesticide mixing and handling precautions would be followed as specified for the material being used. Loading would be by means of hose lines equipped with instantaneous shutoff valves to reduce the risk of spillage.

Procedures for containing and cleaning insecticide spills and handling aircraft and vehicle accidents are covered in the Aviation Management Plan. A copy of the Plan would be at the loading site and copies are given to all field crews.

2.4 Monitoring

Gypsy moth activity was originally detected through aerial detection monitoring, and treatments were prioritized based on past gypsy moth activity and egg mass surveys to determine current populations and risk. Continued monitoring is an important part of the environmental assessment process to ensure that suppression actions are implemented as planned and that the results are as predicted. In addition to the on-site implementation monitoring that would occur during spray application, aerial and ground defoliation surveys would be conducted in early summer to monitor gypsy moth defoliation, and egg mass surveys would be completed in the fall to monitor for treatment effectiveness. This monitoring would be conducted by USDA Forest Health Protection staff.

2.5 Comparison of Alternatives

No treatment activities would occur under Alternative 1, No Action. In comparison, an estimated 13,140 acres of high-priority areas would be treated under Alternative 2, the Proposed Action. There would be no ground disturbance or vegetation manipulation under any alternative.

Table 2.2 summarizes the potential effects that Alternatives 1 and 2 would have on the issues described in Chapter 1.

Table 2.2 Comparative Summary of Each Alternative and its Potential Effects

Issue	Alternative 1 No Action	Alternative 2 *Btk* and Gypchek Treatments
Issue 1 Effects of gypsy moth defoliation on timber and vegetation resources	Untreated lands may receive excessive tree defoliation, causing additional tree stress with a high potential for growth loss and tree mortality. Consequently, populations may spread to un-infested areas where defoliation could be light, moderate or heavy, depending on the availability of gypsy moth preferred tree species.	Implementation of this alternative would reduce the likelihood of gypsy moth defoliation on treated lands and would reduce the potential for gypsy moth to spread into the un-infested areas. The treatment blocks and surrounding areas should see a corresponding reduction in risk to timber from defoliation-related growth loss and mortality.
Issue 2 Effects of *Btk* applications on non-target organisms, specifically threatened and endangered (T&E) species, and non-target moth and butterfly species	No insecticides would be used, resulting in no direct effect of treatment on non-target organisms.	*Btk* may impact some non-target moth and butterfly species in the treatment areas, which may slightly reduce the forage species available for Indiana bats in the short term. However, Indiana bats have not been found in the treatment areas, and if they do occur there, they have the ability to move to other areas to forage. Other T&E wildlife species should not be affected, and T&E plant species should not be affected.
Issue 3 Effects of gypsy moth defoliation and treatments on soil and water resources	This alternative would result in continued defoliation of the host types within the project area. The potential for impacts to soil and water (erosion, sedimentation) would increase as the level of gypsy moth defoliation increases.	Treatments should result in no risk or impact to soil productivity or water quality.
Issue 4 Effects of gypsy moth defoliation and treatments on recreation and scenic resources	Nuisance from gypsy moth caterpillars may reduce recreation days due to loss in quality of the recreational experience. Tree defoliation and mortality would reduce visual quality.	Aerial applications of *Btk* and Gypchek could temporarily affect recreational use by dissuading visitors from using the treatment areas during spray operations. Excessive defoliation would be averted and nuisance from caterpillars feeding would be reduced and would not interfere with recreational activities. Proposed treatments would help maintain visual quality in the area.

2.6 The Preferred Alternative

The preferred alternative for this project is Alternative 2, the Proposed Action.

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 Introduction

This chapter describes the affected environment of the Gypsy Moth Suppression analysis areas, and it presents the potential effects by resource that may result from implementation of each of the alternatives.

For each resource or issue, geographic areas and time frames are described for which potential effects are analyzed. These areas and time frames comprise the "Scope of the Analysis".

The environmental consequences are described as the direct, indirect, or cumulative effects of carrying out the proposed action or not (no action). Direct effects are caused by an action and occur at the same time and place. Indirect effects are caused by an action, but occur later in time or farther removed in distance. Cumulative effects result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions (40 CFR 1508.7-1508.8). The effects disclosed in this chapter provide the basis for the comparison of effects of the alternatives considered in detail (Chapter 2) and will be used by the decision maker in selecting an alternative for implementation.

In accordance with 40 CFR 1502.16, the analyses also include any adverse environmental effects that cannot be avoided, and any irreversible or irretrievable commitment of resources. Irreversible commitments are those that cannot be reversed (e.g. when a species becomes extinct), except perhaps in the extreme long term (e.g. removing an old growth forest). Irretrievable commitments are those that are lost for a relatively long period of time. The analyses also disclose consistency with the Monongahela Forest Plan and any applicable laws, regulations, or agency handbook direction. The information presented in this chapter provides a base for understanding how the proposed action may influence current conditions and the resource issues described in Chapter 1.

This chapter is organized into the following sections:

3.1 Introduction

3.2 Soil Resource

3.3 Water Resource

3.4 Timber Resources

3.5 Recreation Resources

3.6 Threatened, Endangered, and Sensitive Wildlife Species

3.7 Other Wildlife Species of Concern

3.8 Threatened, Endangered, and Sensitive Plants

3.9 Non-target Lepidoptera

3.10 Aquatic and Riparian Resources

3.2 Soil Resource

This analysis addresses potential effects to the soil resource as part of Issue 3 described in Chapter 1: Effects of gypsy moth defoliation and treatments on soil and water resources. Concerns under this issue include impacts to soil characteristics.

3.2.1 Scope of the Analysis

The spatial boundary used to address impacts is the entire project area (blocks to be sprayed on federal land) and the cumulative effects area includes adjacent and non-adjacent spray blocks within proximity to the project area as described in Chapter 2 for the Proposed Action. This area allows for the assessment of past and future effects and the determination of threshold impacts to soil quality as defined the Region 9 Soil Quality Standards FSH 2518.

There are two temporal frames for this effects analysis, short term and long term. Direct, indirect, and cumulative effects can occur within short-term and long-term time frames. Short-term effects to soils are considered to occur over a period of a week or less due to the application of pesticides and their half life for breakdown on foliage and in soil. Long-term effects are considered to be 10 years or the shelf life of this analysis. Gypsy moth infestation has been occurring in this area for decades in a mosaic pattern on the landscape and has had past and present effects to soil productivity and forest health to varying degrees (see Chapter 2 for discussion and the Draft Supplemental EIS for Gypsy Moth Management, USDA Forest Service, Newton Square, PA).

3.2.2 Affected Environment

The existing condition of the soil resource is described in general (1:24,000 scale) by the soil resource inventory conducted by the USDA-Natural Resource Conservation Service and published in hard copy in the Pocahontas County Soil Survey (1992) and available on-line through Web Soil Survey (www.websoilsurvey.gov). A map of the soil map units is located in the project file (PF, M03). The soils in this area of the Forest form out of sedimentary rock made up of shale, sandstone, and some limestone. In general precipitation is low compared to the western portion of the Forest. Soils have less soil moisture here and tend to be shallower and droughtier.

No site-specific monitoring of soil productivity has been done in the project area related to gypsy moth defoliation; however, the project area has been monitored for baseline soil properties (summer 2007), both physical and chemical, as a part of other on-going projects related to future prescribed fire treatments and timber harvesting opportunities. That data is located in the project file of the White Sulphur Prescribed Burn Categorical Exclusion Decision, and additional data resides on the J drive of the soil resource monitoring files for FY2008.

3.2.3 Direct, Indirect, and Cumulative Effects

Alternative 1 – No Action

Direct, Indirect, and Cumulative Effects - The direct, indirect, and cumulative effects to the soil resource from the presence of gypsy moth infestations are described in the existing 1995 Gypsy Moth Management in the United States Final EIS, Appendix G (Environmental Risk Assessment). The 1995 document specifically looks at changes in soil microclimate (temperature and moisture), pH, nutrients, productivity, and overlying forest health issues as a result of gypsy moth activity. In summary, the presence of the gypsy moth at infestation levels that induce multiple defoliation cycles amongst the overstory can cause adverse changes in those soil characteristics and can result in long-term forest health issues and tree mortality. It is not likely that the project area is seeing these types of effects yet, as most areas have only experienced one season of defoliation in this latest cycle of gypsy moth activity. In addition, soil productivity issues are also cyclic and dependent on multiple factors

in the environment, and therefore gypsy moth activity may not always result in long-term adverse effects. However, if defoliation continues under no action in 2009 and beyond, the risk of long-term effects to soils would increase.

Alternative 2 - The Proposed Action

Direct and Indirect Effects - Treating the infestations of gypsy moth prevents or minimizes those potential adverse effects to the soil resource described in the No Action Alternative.

The actual treatments using *Btk* or Gypchek do not have any documented adverse effects to the soil resource. *Btk* is a natural-occurring organism in the soil and Gypchek is made up of the virus that is a natural killing agent to the gypsy moth. Actual monitoring of the forest floor shows that aerial application of both of these biochemical agents may not actually reach the forest floor due to several factors. The primary factor is that the droplet size is so tiny (100 to 200 microns) that the majority of the pesticide is intercepted by the various layers of vegetation, therefore causing no direct or indirect effect to the soil.

Cumulative Effects - There are no cumulative effects long term or short term to the soil resource from the addition of the pesticides since they do not readily come in contact with the soil, are naturally occurring in the environment, and have relatively short half-lives.

Unavoidable Adverse Impacts

There are no unavoidable adverse impacts to the soil resource from proposed activities under Alternative 2.

3.2.4 Irreversible or Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of the soil resource in this project due to method of the application of the pesticides (aerial application) and the nature of the composition of the pesticides being used in the project.

3.2.5 Consistency with the Forest Plan, Laws, Regulations, and Handbooks

All alternatives would be implemented consistent with Forest Plan goals, objectives, standards, and guidelines as explained in the Standards and Guidelines of the Forest Plan for the Soil Resource (Monongahela National Forest Land and Resource Management Plan, pp. II-9 through II-11).

All alternatives would be implemented consistent with Forest Service laws, regulations, and handbooks regarding management of the soil resource.

3.3 Water Resource

This analysis addresses potential effects on water as part of Issue 3 described in Chapter 1: Effects of gypsy moth defoliation and treatments on soil and water resources. The potential impacts to water quality from gypsy moth defoliation and treatments are of concern.

3.3.1 Scope of the Analysis

The spatial boundary for this analysis is the project area (12 treatment blocks that total an estimated 13,140 acres) within the 6th level watersheds that encompass those treatment blocks. Hydrologic Unit Codes (HUCs) identify those watersheds within the hierarchy of the river system. The entire project area is within three 5th level watersheds of the Greenbrier River sub-basin, HUC 05050003. The three 5th level watersheds include: Sitlington Creek-Greenbrier River #0505000304, Anthony Creek #0505000305, and Howard Creek #0505000306. Within these, treatments would occur within eight 6th level HUCs (with total HUC acreage in parenthesis):

Locust Creek-Greenbrier River #050500030407(36,314 ac.)
Slabcamp Run-Greenbrier River #050500030408(26,126 ac.)
Meadow Creek (Upper Anthony) #050500030501(15,184 ac.)
North Fork Anthony Creek #050500030502(14,262 ac.)
Upper Anthony Creek #050500030503(20,974 ac.)
Middle Anthony Creek #050500030504(13,210 ac.)
Lower Anthony Creek #050500030505(30,986 ac.)
Headwaters Howard Creek #050500030602(17,022 ac.)

The cumulative effects analysis area includes treated and untreated lands, both government and private ownership, within the 6th level HUC watersheds listed above. This area allows the analysis of past, present and future effects to water resources from the proposed spray treatments.

The temporal boundary for this analysis is determined by the expected duration of direct, indirect and cumulative effects of the proposed spray treatments. Duration of water quality effects from gypsy moth defoliation could potentially last for months for some indicators of water quality, to a year or more in the case of other indicators (stream flow or temperature increases), but would depend on severity of defoliation and extent of the channel system impacted, among other things. Potential duration of water quality effects from either *Btk* or NPV (Gypchek) would be extremely short. The 1995 Gypsy Moth Management in the United States FEIS prepared by USDA (hereafter referred to as the 1995 FEIS) cited two field studies in which viable *Btk* spores were found in rivers for 13 days (Menon and de Mestral 1985), and up to four weeks following spraying (Buckner and others, 1974). *Btk* is not expected to persist in the aquatic environment for more than two to four weeks at the most, and some sources cite shorter duration of persistence (one week). For NPV, the most significant environmental factor affecting its environmental persistence is sunlight (Ignoffo 1992). It lasts longer dry than wet, but in general water does not greatly affect survival. Podgwaite and others (1979) reported the activity of NPV from spray deposits was measurable for 3 to 15 days. And the 1995 FEIS said that when applied aerially, Gypchek persists for about two weeks. Thus the temporal boundary for *Btk* and Gypchek being used in this analysis is two to four weeks.

3.3.2 Affected Environment

The proposed *Btk* spray treatments would occur on an estimated 12,669 acres, and Gypchek spray treatments on 471 acres, largely within Greenbrier County but a small portion within the extreme southern end of Pocahontas County. Most of the proposed treatment acres would be along ridges and some mid-slope positions in the headwaters of named streams. But portions of some spray blocks would either approach, border, or spray over certain larger named streams, including Spice Run, North Fork Anthony Creek, Meadow Creek and Laurel Run of Meadow

Creek. Most treatment blocks sprayed would include areas with small intermittent and ephemeral stream channels that have an almost entirely intact forest canopy over the channel system. Perennial streams also occur within spray blocks, and these also have an essentially intact riparian community and forest canopy over most of the channel system. The larger streams such as North Fork Anthony, Meadow Creek and Laurel Run also have largely intact riparian forested communities with a forest canopy over the active channel. Small openings in the canopy likely occur over stream channels within or close to spray blocks, but these openings represent a very small proportion of the total channel length of what could potentially receive direct spray.

Streams within the analysis area have mostly good to very good water chemistry. Streams are well to fairly well buffered against the potential adverse effects of acid deposition. Since the fall of 2001, nine streams within the analysis area or nearby have been sampled and tested for water chemistry characteristics. All but one have moderate to very good pH and ANC (acid neutralizing capacity). The one exception was upper Meadow Creek (upstream of Lake Sherwood). Fall chemistry in upper Meadow Creek improves somewhat, but upper Meadow Creek is considered to be somewhat susceptible to adverse effects of acid deposition, at least seasonally. Downstream of the lake, Meadow Creek water chemistry improves somewhat.

Five streams within the analysis area are listed in the WV 303(d) report for 2006 as being impaired waters. They include the Greenbrier River for its entire length, Little Creek its entire length, Whites Draft and an un-named tributary of Whites Draft, and the first 2.6 miles (from the mouth) of Meadow Creek. All are included as impaired waters for one criterion only, which is fecal coliform. The state report lists the source of the contamination as "Unknown" for each of these water bodies. (All of these streams have been removed from the DRAFT 2008 WV 303(d) list, and moved to an appendix list pending approval of TMDLs for these streams.) Fecal coliforms are associated with fecal contamination from warm-blooded animals, and are not associated with gypsy moth infestations.

Most streams within the analysis area likely are moderate to high in fine sediments within the stream substrate. Suspended sediment increases in all streams during periods of storm runoff, but almost always returns to low levels soon after storm peaks and during base flow conditions unless active channel disturbances are occurring. None of the streams within the analysis area are listed in the 303(d) report for reasons of sediment impairment, even though substrate fine sediment composition is frequently higher than desirable for healthy aquatic habitats. The 1995 FEIS cites some sources that attribute the potential for increased sediment delivery to streams resulting from extensive gypsy moth defoliation.

Stream flows are typical of un-regulated watersheds within this area. Flows fluctuate widely in response to rains, snowmelt, seasonal patterns, drought, land use and other factors. The only stream in the analysis area that has flow regulation to any substantial degree is Meadow Creek below Lake Sherwood. This lake stores water from the upper watershed, and moderates downstream peak flows to a degree. Otherwise stream flows within the analysis area respond to the above mentioned influences, and also may be influenced by such things as timber harvest, grazing and other agriculture, and extent of other developments within the watershed. It has been reported by some that extensive gypsy moth defoliation within a watershed may increase stream flows by reducing evapotranspiration and direct foliar interception of precipitation.

3.3.3 Direct, Indirect, and Cumulative Effects

Alternative 1 – No Action

Direct and Indirect Effects - In the No Action Alternative, there would be no spray treatment on federal lands with either *Btk* or Gypchek to suppress the gypsy moth. Gypsy moth outbreak and defoliation on the Forest would occur as governed by natural processes, without human intervention. The likely effect on the 13,000+ acres (proposed for spray treatments in the Proposed Action) would be moderate to heavy defoliation in the absence of

spray treatments. Defoliation on the Forest also could be increased by gypsy moth populations on adjacent or nearby private lands on which no suppression activities are occurring.

The effects of gypsy moth defoliation on water are described in the 1995 FEIS. Effects of moth infestation on water quality and quantity depend on their densities and degree of defoliation, and on repeat or subsequent defoliations. Defoliation can increase stream water temperatures by reducing shade in the riparian and streamside zone, increase stream nutrient concentrations by converting leaves to frass, and alter stream flows and water yield especially when substantial tree mortality results. Increased water temperature during the warm seasons, especially during low flows, reduces the oxygen holding capability of water, further stressing aquatic biota during a time when they are experiencing stresses from other factors as well. Sheath and others (1986) documented a 6.7 degree F increase in stream temperature following a major gypsy moth outbreak in Rhode Island. But because stream water temperature may also be influenced by flow volume and groundwater inputs, channel gradient and some other factors (Barton *et al.* 1985), changes in water temperature would vary from site to site and depend on the combination of important factors, in part the degree and duration of defoliation. Also, changes in stream water temperature may somewhat quickly be attenuated as water flows back into shaded channel, reducing downstream effects.

The areas of potential defoliation of concern (those in the proposed spray blocks) are largely higher on the landscape along ridges and mid-slopes, but some acreage also occupies lower slopes along some perennial and intermittent stream channels. Some of these streams may experience water temperature increases during the late spring to fall that would be detrimental to trout and other aquatic biota (see the Aquatic Resources section). It is not likely that any of the streams within the analysis area would be affected to a level of causing them to be listed as 303(d) impaired. The duration of water temperature effects would likely be relatively short as trees grow new leaves, but could last longer if extensive tree mortality occurred in a given watershed.

The 1995 FEIS said that the consequences of defoliation, such as increased nutrient content in forest litter and increased water yield and flow rates, could potentially cause increased nutrient transport to waters adjacent to severely defoliated areas. Grace (1986) concluded that while nutrient levels were higher for litter components falling during the growing season, the increase in nutrients that return to the forest floor as a result of defoliation are relatively modest. The 1995 FEIS said that gypsy moth defoliation would likely have little effect in terms of substantial nutrient enrichment (eutrophication) of adjacent waters (Corbett *et al.* 1978; Grace 1978).

Gypsy moth defoliation may contribute to changes in stream chemistry and reduced ANC in streams in some upland watersheds of the southern Appalachians (USDA, 1994). Downey (1991) reported that gypsy moth defoliation could temporarily result in conditions more typical of winter months in terms of reduced ANC and lower pH. The 1995 FEIS cites studies that report on various aspects of this phenomenon, and said that since recurrences of defoliation can be expected, the cumulative effects on nitrate mobility and stream acid-base chemistry may be significant (USDA 1994). The potential for moth defoliation within the project area to substantially affect acid-base relationships and ANC/pH levels in streams is expected to be low, however, partially due to the adequate pH/ANC characteristics of streams within the area. The possible exception would be upper Meadow Creek with its lower pH and ANC (especially in the spring), which could make it somewhat more susceptible to reduced ANC resulting from recurring defoliations.

Defoliation has also been shown to increase water yield from a watershed (Corbett and Lynch 1987). Nearly all of that increase is likely to occur during low flows and base flows, while little or no increase in peak flows would be expected. Increased low flows in the area streams would generally be considered a benefit. Increases in water yields from forested

watersheds may enhance ground water recharge (Sharpe 1982), and during low flow conditions it would improve stream habitat. And while defoliation could theoretically lead to increased erosion and sedimentation, the 1995 FEIS concluded that "increased watershed erosion as a result of gypsy moth defoliation is unlikely."

The risk of altering the indicators of water quality is greater in the No Action alternative than the Proposed Action because of the effects of defoliation, as discussed above. None of these possible effects are expected to be substantial in streams within the project area, especially from a single defoliation.

Cumulative Effects - No substantial adverse cumulative effects to water quantity or quality resulting from a single gypsy moth defoliation on the National Forest would be expected. With multiple defoliations, the risk to some measures of water quality may increase. Repeated defoliations, especially when they result in substantial tree mortality within a single watershed, may affect some measures of water quality like temperature, water yield, and nutrient levels. None of these effects would be expected to be severe enough to cause streams to be listed in the WV 303(d) report as impaired. Within the analysis area, other management activities on public and private lands may have effects that could cumulatively contribute to some effects of defoliation, such as cleared lands, grazing in riparian areas, and timber harvest. While these other management activities occur within the analysis area, they are not extensive enough or in close proximity to the project treatment areas to substantially contribute to cumulative adverse effects from defoliation there. Gypsy moth populations on private lands within the analysis area is one unknown in the cumulative effects situation, and could cumulatively contribute to greater water quality effects if populations are high and result in severe defoliation on lands adjacent to the project areas. High infestations on adjacent private lands would likely result in new areas of infestation on the Forest, or more severe outbreaks and defoliation/mortality within the project area. At some point the cumulative effects of these could overwhelm a watersheds capability to accept impacts and maintain stability, resulting in more substantial adverse effects to water quality.

Alternative 2 - The Proposed Action

As stated above, the proposed *Btk* spray treatments would occur on an estimated 12,669 acres, and Gypchek spray treatments on 471 acres, within portions of eight 6th level HUCs that collectively encompass over 174,000 acres. Proposed treated acres represent less than 8 percent of the total 6th level HUC acreage. The highest percentage of a 6th level HUC that would be treated is in the Meadow Creek (Upper Anthony Creek) watershed, with 32.6 percent of the HUC acreage proposed for treatment with *Btk*.

The 1995 FEIS stated that *Btk* enters the aquatic environment through direct application to surface water, runoff from the watershed, or from feces of animals that have ingested the spores. It is aerially applied in early spring before leaves of deciduous trees are fully expanded. *Btk* spores and protein crystals are distributed on vegetation on and below the upper canopy, on litter and soil, and inadvertently in some surface waters (streams) under the canopy or nearby due to spray drift. *Btk* does not persist in the aquatic environment for more than a few weeks (Buckner and others 1974; Menon and de Mestral 1985).

Indirectly through reduction in defoliation, *Btk* treatments are likely to reduce the risk of possible changes in water quality and quantity that can occur with gypsy moth infestations. *Btk* provides the greater degree of foliage protection, and would provide the greater protection against defoliation-caused changes in water quality. The *Btk* treatment itself is not likely to affect water quality (1995 FEIS). There should be no change in stream microclimate from that of a healthy un-infested forest due to *Btk* applications (1995 FEIS), so water temperature effects would not occur as defoliation would be avoided.

The NPV virus for gypsy moths is a pathogen specific to gypsy moths found naturally in the environment. Gypchek is the product that contains the virus, and is applied as an insecticide, and its application augments naturally occurring populations of NPV, or introduces it into new areas in the spray. In general, water does not greatly affect NPV survival, especially for short-term exposures (Ignoffo 1992). Applied aerially the insecticide persists for about two weeks.

Similar to *Btk*, Gypchek treatments limit the severity of gypsy moth defoliation, thus substantially reducing or avoiding the risk of defoliation-induced water quality changes. Any risk of altering water quality from NPV treatments would be from reductions in gypsy moth egg masses hatching in the year following spraying. NPV itself poses no risk to altering water quality (1995 FEIS). And possible changes in stream microclimate resulting from defoliation would have low risk with the use of Gypchek, thus minimizing the risk of water temperature effects.

Potential effects on water quality would further be mitigated by the extremely low quantity of either *Btk* or Gypchek that may inadvertently be deposited in or find its way into surface waters. As stated previously, applications occur during partial leaf-out. Nearly all of the potentially affected stream channel lengths within proposed treatment blocks have a nearly intact forest canopy covering over the channel, so the great majority of spray over or near small streams would be deposited on the forest canopy. Spray buffers along the largest streams would also limit spray drift into these larger channels (Spice Run, North Fork Anthony Creek, and Meadow Creek). The potential for adverse water quality effects from *Btk* treatments is extremely low, and NPV poses no risk to altering water quality.

For these reasons, and because of the low application volumes (refer to Chapter 2) and limited duration of persistence, no substantial adverse water quality or quantity effects are expected from either the proposed *Btk* or Gypchek treatments in any of the spray blocks.

Wetlands and Floodplains. Small isolated wetlands occur along the Meadow Creek stream bottom, but would not be sprayed over, and would not be close enough to receive any appreciable amount of spray drift. No adverse effects to wetland functions or values would occur. Some narrow areas of floodplain occur along Meadow Creek and Laurel Run of Meadow Creek, but the proposed spraying would have no adverse effects on floodplain functions or values.

Public Water Supplies. Several public water supplies occur within the analysis area, but none would be expected to be impacted in any way from the proposed spray treatments. Public water supplies at Lake Sherwood are supplied by wells at the recreation area, and are well upstream and over a mile from the nearest proposed spray block #16. The Anthony Correctional Center at Neola has wells that serve the population there, so their water supply is protected from possible spray drift, and is located well over a mile from the nearest spray block #18. A large spring just north of State Route 16 at Alvon serves as the water source for the Greenbrier Hotel and complex in White Sulphur Springs, but is a protected water supply and is over two miles northeast of the nearest spray block #21. Another smaller, protected spring on the south side of Route 16 is the water supply for Camp Wood (just downstream from Alvon), and is also more than two miles from the nearest treatment block #21. The Blue Bend Recreation Area is served by a well at the campground, so the water supply is protected and also is more than two miles northwest of the nearest treatment block #21. None of these areas would be close enough to receive spray drift because of the mitigations and protections to be implemented in carrying out the spray treatments, and because of the distances from the treatment blocks. Also, none of these public water supplies is a surface source, and are protected from direct aerial contamination. None of these public water supplies would be adversely affected by any of the proposed spray treatments.

Cumulative Effects - There are no substantial short or long-term adverse cumulative effects of either the *Btk* or Gypchek treatments on 13,140 acres of National Forest to water quantity or quality. And there are no anticipated adverse effects downstream within the 6th level watersheds that comprise the analysis area. Water quality or flow effects downstream would not likely be observable. There are no known gypsy moth spray treatments occurring on private lands anywhere near the National Forest lands that are proposed for treatment. Spraying for gypsy moth with Dimilin in Calvin Price State Forest adjacent to treatment area 36 is expected in 2009, but would not occur on the same acreage, and only on a few acres of the same named watershed (Spice Run).

Unavoidable Adverse Impacts

There are essentially no unavoidable adverse impacts to water, wetland and floodplain resources from activities included in the Proposed Action. Neither *Btk* nor NPV (Gypchek) persist in the aquatic environment for more than a few weeks. *Btk* is not likely to affect water quality, and NPV poses no risk of altering water quality (1995 FEIS). No adverse effects to wetland or floodplain functions or values would occur. None of the closest public water supplies would be adversely affected by the proposed spray treatments.

3.3.4 Irreversible or Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitments of the water, wetland or floodplain resources analyzed in this report as a result of either the No Action or the Proposed Action.

3.3.5 Consistency with the Forest Plan, Laws, Regulations and Handbooks

Both alternatives analyzed in this report are consistent with the Monongahela National Forest Land and Resource Management Plan, all applicable laws, and all Forest Service regulations and handbook direction pertaining to protection and management of water, wetland and floodplain resources.

3.4 Timber Resources

This analysis addresses potential effects to timber or tree vegetation as described in Issue 1 in Chapter 1: Effects of gypsy moth defoliation on timber resources. Concerns under this issue include impacts to tree species diversity, age class distribution, and general health and vigor from defoliation.

3.4.1 Scope of the Analysis

The spatial boundary used to address impacts is the entire project area (blocks to be sprayed on federal land) and the cumulative effects area includes adjacent and non-adjacent spray blocks within proximity to the project area as described in Chapter 2 for the Proposed Action. This area allows for the assessment of past and future effects and the determination of threshold impacts to soil quality as defined the Region 9 Soil Quality Standards FSH 2518.

There are two temporal frames for this effects analysis, short term and long term. Direct, indirect, and cumulative effects can occur within short-term and long-term time frames. Short-term effects to soils are considered to occur over a period of a week or less due to the application of pesticides and their half life for breakdown on foliage and in soil. Long-term effects are considered to be 10 years or the shelf life of this analysis. Gypsy moth infestation has been occurring in this area for decades in a mosaic pattern on the landscape and has had past and present effects to soil productivity and forest health to varying degrees (see Chapter 2 for discussion and the current 2008 Gypsy Moth Management EIS, USDA Forest Service, Newton Square, PA.)

3.4.2 Affected Environment

In June of 2007, aerial detection flights by the USDA Forest Service and the West Virginia Department of Agriculture revealed approximately 1,200 acres of defoliation on the Marlinton/White Sulphur Ranger District (MWSRD). Subsequent on-the-ground field surveys indicated a large amount of dead gypsy moth caterpillars and a low amount of egg masses. In July, 2008, aerial detection flights found gypsy moth defoliation had spread to approximately 7,600 acres on National Forest System land. Egg mass surveys completed in the fall of 2008 by Forest Health Protection employees with the USDA Forest Service State & Private Forestry indicate approximately 13,000 to 14,000 acres of Monongahela National Forest land are susceptible to moderate to severe defoliation in 2009.

Gypsy moth egg masses remain over the winter months and hatch the next generation of young caterpillars in the spring. During severe infestations, nearly all of the leaves or needles from trees susceptible to gypsy moth may be eaten. When this occurs, hardwood trees will often produce a new crop of leaves. Although this enables the trees to survive, it also weakens them, making them more susceptible to other disease and insect attacks or climate factors such as drought. These additional stresses increase the potential for the tree to die, especially if defoliation occurs two or more years in a row. Pines and other conifers do not produce a new crop of foliage, and can die after one season of defoliation.

Stands that have tree species preferred by gypsy moth containing greater than 20 percent of the basal area of the stand are particularly at risk (Liebhold *et al.* 1997). Of the 20 top tree species that are preferred by gypsy moth, 9 of these species are found within the proposed treatment area: white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), post oak (*Quercus stellata*), scarlet oak (*Quercus coccinea*), American basswood (*Tilia americana*), bigtooth aspen (*Populus grandidentata*), and Eastern hophornbeam (*Ostrya virginiana*). A random review of the vegetation inventory database of stands on national forest land within the proposed treatment area found over 90 percent of the stands contain at least 20 percent of the basal area of these tree species preferred by gypsy moth.

3.4.3 Direct, Indirect, and Cumulative Effects

Alternative 1 - No Action

The environmental effects of areas infested with gypsy moth not receiving treatment would, in most cases, allow moderate to severe defoliation. In a severe defoliation, numerous other tree species would be affected, including hickory and pine trees. A complete list of trees and shrubs that are at risk of defoliation during severe outbreaks of gypsy moth can be found in Appendix D of the Gypsy Moth Management Draft Supplemental Environmental Impact Statement (DSEIS) (USDA, 2008).

Defoliation can result in physiological stress, making trees susceptible to drought-induced stress, or other pest attacks. A more detailed explanation of the effects of defoliation by gypsy moth can be found on pages 4 – 6 of Chapter 4 in the Gypsy Moth Management Draft SEIS, Volume II (USDA, 2008)

The short-term, direct, adverse effects of defoliation include:
- increase in tree mortality,
- elimination of oak mast production,
- loss of shade,
- loss of aesthetics, and
- increased fire danger due to solar drying of exposed leaf litter

(USDA 1995, Vol. I, pp. 14-16).

The most pronounced effects occur when severe gypsy moth outbreaks cause heavy defoliation. After a single year of heavy defoliation, tree condition suffers and mortality increases. A study conducted in West Virginia has shown that after one year of heavy defoliation, an average of 25 percent oak mortality can be expected (Atkins and Mayhew, 1986). Since tree mortality can happen over a time period of one year or greater, it can be considered either as a short-term or long-term cumulative effect. Production of both wood and hard mast (nuts) temporarily declines, and the growth rate of many shrubs and herbaceous plants may increase.

Two years of heavy defoliation greatly reduces the production of wood, hard mast (nuts), and soft mast (berries). Shoestring fungus and two-lined chestnut borer, which attack and kill trees weakened by defoliation, become more abundant. Mortality is likely within 5 years, both among oaks and among species less favored by the gypsy moth.

Three years of heavy defoliation causes high mortality in oaks and less-favored hosts; wood growth is drastically reduced, and production of hard mast will likely cease for at least 5 years. Regeneration of young forest to a mature forest requires decades, and in areas where trees less-favored by the gypsy moth remain, stands are dominated by species such as red maple, yellow poplar, black cherry, and yellow or black birch (Gypsy Moth Management DSEIS – Volume 1: Summary, USDA, 2008).

Alternative 2 – The Proposed Action

Treating the infestations of gypsy moth minimizes potential adverse effects to the vegetation resource as described in the No Action Alternative. Because the agents sprayed in this project are naturally occurring insecticides, no direct effects to vegetation are expected from the treatments. The primary indirect and cumulative effects to vegetation should be a reduction in defoliation in treated stands, and a reduction in overall stress and mortality to the trees that have been defoliated in the past year or two.

Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to vegetation from proposed activities under Alternative 2.

3.4.4 Irreversible or Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of vegetation in this project due to method of the application of the pesticides (aerial application) and the nature of the composition of the pesticides being used in the project.

3.4.5 Consistency with the Forest Plan, Laws, Regulations, and Handbooks

All alternatives would be implemented consistent with Forest Plan goals, objectives, standards, and guidelines as explained in the Standards and Guidelines of the Forest Plan for vegetation and pesticide management (Monongahela National Forest Land and Resource Management Plan, pp. II-17 through II-21). All alternatives would be implemented consistent with Forest Service laws, regulations, and handbooks regarding management of the vegetation and pesticide management.

3.5 Recreation Resources

This analysis addresses potential effects to recreation resources as described in Issue 4 in Chapter 1: Effects of gypsy moth defoliation and treatments on recreation and scenic resources. Concerns under this issue include impacts to visual quality and recreation opportunities from defoliation and tree mortality, particularly along travel corridors such as roads, recreation trails, and overlooks.

3.5.1 Scope of the Analysis

The spatial boundary used to evaluate direct, indirect, and cumulative impacts are the specific treatment blocks. This area was selected because the effects of aerial spraying to recreation with *Btk* or Gypchek are limited to the area directly being treated. Within the project boundary there are no developed campgrounds, no day use areas, or concentrated use areas. Approximately .75 miles of Trail #701 are within treatment area 2, and Trail #611 borders treatment area 26.

The temporal boundary used to assess impacts was one month, which is slightly longer than the longevity of aerial treatments being used. As discussed below, most negative impacts to the action alternative occur the day of treatment. It is assumed that any negative impacts to the no action alternative will continue and spread, well after the timeframe of this decision.

3.5.2 Affected Environment

The desired condition for recreation management on the Monongahela National Forest (Monongahela) is to offer a wide spectrum of recreational opportunities. The Management Prescriptions in the Forest Plan provide for a variety of recreational settings, from semi-primitive backcountry, to roaded areas with motorized access and developed recreation complexes. Dispersed recreation opportunities abound for hiking, backpacking, fishing, hunting, and trail use.

The Monongahela also provides some of the highest quality scenic landscapes in the East. Enjoyment of these scenic resources is an integral part of many recreation experiences, and these scenic attractions have contributed to making a number of locations on the Forest nationally recognized recreation destinations (USDA FS 2006b).

The Monongahela is a major outdoor recreation attraction in the State of West Virginia. Visitor use estimated the Forest receives about 1.3 million visitors annually. Tourism represents an ever-increasing portion of the state economy in West Virginia and trails are developing into the backbone of the state outdoor recreation industry (State of West Virginia 2002). Maintaining a high quality, accessible, and natural appearing trail system is important both for the resource and the visitors using trails on the Forest.

Currently, there are five congressionally designated wilderness areas and six proposed wilderness areas on the Monongahela totaling just over 118,000 acres. Treatment of insects and disease are allowed in wilderness areas with Regional Forester approval providing; a) there is an immediate threat of unacceptable damage to resources outside the wilderness boundary or of unnatural loss of the wilderness resource due to exotic pests, and b) the threat cannot reasonably be abated by control actions taken outside the wilderness boundary. There is one proposed wilderness area (Spice Run) that could be affected by proposed gypsy moth treatments. No currently designated wilderness areas, scenic areas, or National Recreation Areas fall within the proposed treatment blocks.

Recreation participation on the Forest was determined through surveys which took place on the Forest in 2003. The top five popular recreation activities were 1. viewing natural features, 2. viewing wildlife, 3. hiking/walking, 4. relaxing, and 5. driving for pleasure (USDA FS 2004). With all of these activities, the condition of the natural environment is a key element.

3.5.3 Direct, Indirect, and Cumulative Effects

The following section describes environmental consequences for the two alternatives which were studied in detail.

Alternative 1 – No Action

Taking no action to control gypsy moth would have no immediate direct adverse impacts on recreation. However, failure to control the spread of gypsy moth and defoliation caused by high gypsy moth populations may indirectly and adversely affect recreation over the long term. Over time, impacts would exceed the current project boundary. Long-term impacts may include areas of infestation, defoliation of trees, and tree mortality. These impacts would change the vegetation structure, and for most people, greatly reduce the aesthetics of the forest for several years after the defoliation.

Past, present and future recreation activities may cumulatively contribute to the spread of gypsy moth. Recreational activities such as hiking and driving have been proven to facilitate the spread of gypsy moth. It is anticipated that these activities will continue in the project area.

The cumulative effect of no action would be to allow gypsy moth to defoliate trees and to spread, largely unabated, which could have a negative impact on recreation.

Alternative 2 – Proposed Action

The control of gypsy moth would have no direct effects on recreation. *Btk* is nontoxic to humans and unlikely to pose a hazard to human health. Based on epidemiological studies and the long history of its use, there is no evidence that the application of *Btk* has caused adverse effects to the general public (USDA 1995). As with *Btk*, Gypchek is nontoxic to humans and it is highly unlikely to pose a hazard to humans (USDA 1995).

Even though there is no evidence that applying *Btk* or Gypchek has a health risk, avoiding treatment during heavy recreation use days, such as weekends and holidays, is suggested. Appropriate notification of the public should take place in local newspapers, through the Forest website, and postings at trailheads.

Btk or Gypchek would be applied by a low-flying airplane just above the tree canopy. The sight and sound of a low flying aircraft may disturb the recreation experience for some individuals seeking solitude. However, aerial applications are expected to start when light is sufficient for aircraft flight. Application would most likely take place on a weekday in early to mid May. One or two applications would be needed. If a second application is needed, it would be at least 3-7 days after the first treatment.

Use of the proposed Spice Run Wilderness is very low and there are no trails within this area. It is anticipated that few, if any wilderness visitors would be impacted during each application. The effects to wilderness character were closely analyzed. A Minimum Requirements Decision Guide weighed the options to determine the most appropriate action. The analysis in the Minimum Requirements Decision Guide determined that wilderness character would be best protected with treatment. For the full analysis, please refer to the project record (PF, L03).

The main long-term benefit of treating gypsy moth is maintaining current aesthetic values in the treatment areas. Since viewing natural features ranked as the top priority for recreation visitors (see Affected Environment, above), it is important to keep the current scenic conditions.

The possible cumulative effects caused by treatment of gypsy moth as proposed in Alternative 2 would be temporary, relatively small, and essentially negligible to recreation. Impacts from treatments proposed in this project when combined with impacts of past, present, and reasonably foreseeable activities are not expected to contribute to any cumulative loss of recreation experiences.

Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to recreation resources from the proposed action. Some recreational uses in the area could be displaced during actual suppression activities for gypsy moth.

3.5.4 Irreversible or Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitment to the recreation, trails, and wilderness resources within or adjacent to the project area.

3.5.5 Consistency with the Forest Plan, Laws, Regulations, and Handbooks

Alternative 2 is consistent with the 2006 Monongahela National Forest Land and Resource Management Plan for recreation management.

There are no conflicts between Alternative 2 and the Federal, regional, State, and local laws, land use plans, policies, and controls for recreation resources based on the following:

- The Monongahela National Forest Land and Resource Management Plan, USDA Forest Service, September 2006.
- Monongahela National Forest Wild and Scenic River Study Report (1995).
- The National Wild and Scenic Rivers Act of 1968.
- The Wilderness Act, Public Law 88-577, September 3, 1964.
- All alternatives would be implemented consistent with Forest Service laws, regulations, and handbooks regarding management of the soil resource.

3.6 Threatened and Endangered Wildlife Species

This analysis addresses potential effects on federally listed threatened and endangered (T&E) wildlife species as part of Issue 2 described in Chapter 1: Effects of gypsy moth *Btk* treatments on non-target organisms. Concerns under this issue include effects on (1) threatened and endangered species.

3.6.1 Scope of the Analysis

The spatial boundary for direct and indirect effects on T&E wildlife species consists of the proposed treatment blocks (see project area map in EA Chapter 2). This boundary contains all proposed project activities and is the boundary within which all direct and indirect effects will occur. The spatial boundary for cumulative effects on T&E wildlife is the Proclamation and Purchase Unit boundary for the Monongahela National Forest. This is the boundary to which viability requirements are applied by Forest Service directives and the Forest Plan.

The temporal boundary for direct and indirect effects on T&E wildlife species is roughly 2 weeks during the insecticide application. This temporal boundary is also used for the cumulative effects analysis because the contribution to cumulative effects ends when the direct and indirect effects no longer exist.

3.6.2 Affected Environment

Three federally-listed T&E terrestrial wildlife species are known to occur on the Monongahela National Forest: Cheat Mountain salamander (*Plethodon nettingi*), Virginia big-eared bat (*Corynorhinus townsendii virginianus*), and Indiana bat (*Myotis sodalis*). To determine which of the T&E species could be affected by the project alternatives as well as areas defoliated by the gypsy moth last year, a "Likelihood of Occurrence" (LOO) table (Gypsy Moth BA, Appendix A, PF Section O) was completed. In this table, all T&E species known to occur on the Monongahela National Forest (MNF) are listed along with their status and a brief description of habitat requirements. These habitat requirements were compared to existing habitat within the project area, and the following existing information on species was also consulted: district T&E records and files, records of the Natural Heritage Section of the WV Division of Natural Resources, available research literature, various field surveys, and personal communication with various T&E specialists.

Determinations made in the LOO table dictate the level of analysis needed for each T&E species. Any species determined unlikely to occur in the project area are not carried into further analysis. Effects analysis is completed for any species that occur or could possibly occur within the project area. An evaluation of direct, indirect, and cumulative effects from each alternative is made for these species. The key to determining effects is evaluating how the alternative affects the habitat the species uses and, in particular, how it affects the factor that limits the species ability to thrive (limiting factor).

There are no T&E wildlife species that are known to use habitat within the treatment blocks, although the Indiana bat can occur in any generally forested areas throughout the Forest. The closest Indiana bat hibernacula are located an estimated 6 miles and 6.5 miles to the west of the proposed treatment blocks and include Snedegar's Cave and Martha's Cave. Over the last two years (2006 and 2007) a total of 12 sites have been surveyed, yielding a total of 361 bats of 8 different species. No Indiana bats have been caught in or near the project area within the last two years, or historically, but the potential for occurrence cannot be ruled out completely. The nearest Virginia big-eared bat cave is 34 miles to the north and this species is not known or expected to occur near the project area. There is no habitat for Cheat Mountain salamander in the project area. Therefore, the remainder of the analysis for T&E wildlife species will focus on the Indiana bat.

Indiana Bat

Indiana bat distribution is generally associated with limestone karst (solution caves) in the eastern U.S. (Menzel *et al.* 2001). Indiana bats occupy distinct habitat types: caves and mines are used for hibernation during winter, while forested areas are used for summer foraging, roosting, and fall swarming.

Summer foraging and maternity roosting habitat is difficult to quantify at a range-wide, regional, or local level due to variability of known maternity roost sites and lack of knowledge about landscape-scale habitat characteristics. However, Romme *et al.* (1995) described optimal roosting habitat as having 60 to 80 percent canopy cover, an abundance of large trees and snags (>8.7 inches DBH), and a relatively open understory. Tree structure, specifically the availability of exfoliating bark with roost space underneath, is a critical characteristic for roost trees. Timber cutting does not discourage Indiana bats from using dead trees nearby as roosts, and in fact may make them more attractive by allowing more warming by solar radiation (USFWS 1999). Indiana bats use isolated trees in openings as roost trees (Kurta *et a*l. 1993), and they may switch between shaded and unshaded roost trees depending on weather conditions (Callahan et al. 1997; Kurta *et al.* 1996) and physiological requirements associated with thermal regulation. Indiana bat maternity colonies generally use both primary and alternate roost trees (Britzke *et al.* 2003). Loud noise from construction equipment has been known to disturb maternity colonies (Garner and Gardner 1992, cited in Evans *et al.* 1998).

Most known maternity sites have been located in forested tracts in the core of the Indiana bat's geographic range in Missouri, Iowa, Indiana and Illinois (USFWS 1999). However, maternity colonies recently have been reported in heavily forested mountainous areas of western North Carolina and eastern Tennessee (Britzke *et al.* 2003). Four confirmed lactating females have also been found in West Virginia, two of them within the MNF proclamation boundary (USDA Forest Service 2004, Sanders Env Inc. 2008). Colonies generally are found under the loose bark of dead or dying trees, but roosts have been found in tree cavities (Gardner *et al.* 1991).

While summer foraging habitat needs are not well understood (USFWS 1997), Indiana bats prefer to forage within upper forest canopy layers where overstory canopy cover ranges from 50 to 70 percent. Foraging habitat suitability declines slightly above and below this range (Romme *et al.* 1995). Menzel *et al.* (2001) suggested that foraging occurs in riparian areas, upland forests and woodlots, and over ponds. Indiana bats also are known to forage along forest edges, in early successional areas, and along strips of trees extending into more open habitat, but drinking water must be available near foraging areas (Romme *et al.* 1995). Large open pastures or croplands, large areas with less than 10 percent canopy cover, and stands with large, unbroken expanses of young, even-aged forests are avoided or are rarely used (Romme *et al.* 1995).

Indiana bats begin pre-hibernation swarming near caves as early as August, and continue swarming through October or November, depending upon local weather conditions. Swarming entails congregating around hibernacula prior to hibernation and flying into and out of cave entrances from dusk to dawn (Kiser and Elliot 1996). This is a biologically important period because during this time, bats mate and replenish fat reserves prior to hibernating (USFWS 1983).

The population of this species in the core of its range appears to be continuing to decline despite protection efforts at all known major hibernacula. Causes of the decline are not known; however, researchers are focusing on impacts from surrounding land uses, pesticides, heavy metals, and genetic variability. In contrast, hibernacula monitoring in West

Virginia shows that estimated populations have increased since the early 1980s. Most significant caves are gated or fenced, which has protected Indiana bat populations and likely has been responsible for their increases (Wallace 1999).

Human disturbance of hibernating bats and cave vandalism are two primary factors contributing to Indiana bat declines. Other causes may include natural disasters, habitat alteration, chemical contamination, and historic collecting and handling (USFWS 1999).

3.6.3 Direct and Indirect Effects

Alternative 1 – No Action

The No Action alternative would, of course, mean no treatment of any defoliated areas. This would also mean that some of the defoliated areas may be heavily defoliated in 2009, and the gypsy moth outbreak will likely continue to spread.

Alternative 2 – The Proposed Action

Where *Btk* is proposed for use, the potential effects to the Indiana bat are to its insect prey base. The Indiana bat is an opportunistic feeder. It feeds on a wide variety of flying insects including (but not limited to) moths, caddis flies, flies, midges, mosquitoes, flying ants, beetles, stoneflies, and lacewings. The conclusions reached in the Final EIS for Gypsy Moth Management in the United States (1995) state that predators of invertebrates (including bats) are indirectly affected by the effects of gypsy moth defoliation as well as treatments of *Btk*. Gypsy moth defoliation often results in increased tree mortality which may provide additional dead trees and snags with exfoliating bark and cavities that may be used as summer roost sites. Bats dependent on invertebrates are at a higher risk of a reduction in their prey base when *Btk* is used. However, in a two-year post treatment study following moderate defoliation, Sample and others (1994) found that both *Btk* and defoliation produced fewer effects on the food of bats than was observed for areas treated with Dimilin. In addition, no effects are expected to either bat in or near the areas treated with Gypchek, since it is species-specific to gypsy moth larvae. Furthermore, the biological assessment for the Forest Plan revision determined that "Management activities that are not likely to adversely affect the Indiana bat include range management, recreation management, watershed and aquatic habitat restoration, small-scale wildlife habitat management, timber stand improvement, gypsy moth control, and personal firewood cutting" (USDA 2006).

For this project some individual bats will experience a reduction in prey if they are residing and feeding in the area of a *Btk* spray block. However, due to the relatively small size of the proposed treatment blocks, when analyzed on a landscape scale, the bats will be able to move to adjacent unsprayed forested areas and find alternate foraging territory until insect populations return to pre-treatment levels, or they will feed on remaining insect populations that are not affected by *Btk*. Therefore the project will not likely affect the Indiana bat.

3.6.4. Cumulative Effects

Due to the limited application of *Btk* across the suppression project area when compared to these species ranges, there will be no cumulative effects to T&E species.

There have been recent discoveries in West Virginia of white-nose syndrome, which is suspected of leading to mortality in bats, including Indiana and Virginia big-eared bats. The effects from white-nose syndrome have yet to be determined on the Forest or in West Virginia. However, because the action alternatives would have little if any impact to Indiana and Virginia big-eared populations in the analysis area, they would likely not have any measurable contribution to cumulative impacts on these bat populations within the analysis area or beyond.

Effects Determinations

Currently there are no species proposed for listing on the Forest or any proposed critical habitat. The following determinations of effects to T&E species were made in the Biological Assessment for this proposal:

The proposed action would have no effect on Cheat Mountain salamander and Virginia big-eared bat.

The proposed action may affect, but is not likely to adversely affect Indiana bat. There would be no effects beyond those previously disclosed and addressed in the Biological Assessment (USDA 2006) and Biological Opinion (USFWS 2006) for the Forest Plan Final EIS.

Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to T&E wildlife species from the proposed action.

3.6.4 Irreversible or Irretrievable Commitment of Resources

The proposed action would not lead to any irreversible or irretrievable commitments for T&E wildlife species.

3.6.5 Consistency with the Forest Plan, Laws, Regulations, and Handbooks

The proposed action is consistent with the 2006 Monongahela National Forest Land and Resource Management Plan, laws, regulations, and handbook direction pertaining to management direction for wildlife species of concern, such as MIS, RFSS, and BCC.

3.7 Other Wildlife Species of Concern

This analysis addresses potential effects on Regional Forester Sensitive Species (RFSS) and other wildlife species of concern, including Management Indicator Species (MIS), and Birds of Conservation Concern (BCC). This analysis addresses part of Issue 2 described in Chapter 1: Effects of gypsy moth *Btk* treatments on non-target organisms. Concerns under this issue include effects on (1) threatened, endangered or sensitive species.

3.7.1 Scope of the Analysis

The spatial boundary for direct and indirect effects on RFSS and other species of concern consists of the boundaries of the proposed gypsy moth treatment areas. These boundaries contain all proposed project activities and are the boundaries within which all direct and indirect effects will occur. For cumulative effects, the spatial boundary of the analysis is composed of the sixth-level watershed boundaries that contain the proposed treatment areas. This boundary includes the terrestrial ecosystems within which the effects of the project will occur, but is small enough that any contributions of the project to cumulative effects should still be measurable.

The temporal boundary for direct, indirect, and cumulative effects on RFSS and other species of concern is 10 years from the beginning of project implementation. A review of the NEPA documentation is expected to occur after 10 years, at which time a determination will be made on whether the effects analysis needs to be updated or supplemented.

3.7.2 Affected Environment

Management Indicator Species

Implementing regulations for the National Forest Management Act (NFMA) under which the 2006 Forest Plan was prepared require National Forests to select MIS to monitor the effects of Forest management activities on fish and wildlife populations and habitat (36 CFR 219.19). These regulations have since been superseded by new regulations that do not require MIS. However, because the Forest Plan was prepared under old regulations, it contains MIS to monitor effects of management on wildlife habitat and populations. The Forest Plan identifies three terrestrial animal species as management indicator species:

Cerulean Warbler (*Dendroica caerulea*)
Wild Turkey (*Maleagris gallopavo*)
Northern flying squirrel (*Glaucomys sabrinus fuscus*)

The Forest Plan also includes brook trout on the MIS list. This species is discussed in the Aquatic Resources section. One of the terrestrial MIS, northern flying squirrel, has been recently de-listed from the endangered species list and is now a RFSS. There is no potential habitat for the northern flying squirrel in the analysis area; therefore, it will not be discussed further in this document.

Cerulean warbler is a high-interest non-game species associated with large trees, gaps, and complex canopy layering characteristic of old-growth forests It is a forest interior species that is believed to be sensitive to fragmentation. The Forest and West Virginia Division of Natural Resources (WVDNR) are cooperating on an ongoing songbird point count monitoring program that is expected to provide Forest-wide more data on this species.

Wild turkey is also a high-interest game species. In the Appalachians, it is strongly associated with oak mast. It requires herbaceous openings for brood range and it uses shrub/sapling stands for nest sites. Ongoing harvest data collected by WVDNR provides a Forest-wide population index.

The analysis for cerulean warbler and wild turkey will be integrated into the insect eaters section below.

Birds of Conservation Concern and Other Species of Concern

The Monongahela National Forest has over 919,000 acres of diverse habitat used by 230 species of birds. The Forest is comprised of stands of various tree species and age classes, and non-forest areas (e.g., shrubby habitats, wetlands, grassy meadows, other natural and maintained openings, cliffs and rocky outcrops, and streams) that all provide places for birds to feed, rest, and raise their young. This diverse landscape provides habitat for some 70 species of resident birds, 89 breeding neotropical migrants, and 71 non-breeding migratory bird species.

Based on the document "Birds of Conservation Concern 2002" (USFWS 2002), the Monongahela National Forest and the state of West Virginia occur within the Appalachian Mountain Bird Conservation Region (BCR) 28. There are 27 species of birds that are listed as birds of conservation concern for the Appalachian Mountain Bird Conservation Region. However, based on Forest bird surveys, range maps, and the WV Breeding Bird Atlas (Buckelew and Hall 1994) several of these species do not occur on the MNF; the species that are known or expected to occur on the Forest based on surveys or the Atlas are listed in Table 3.1. To simplify a discussion of the potential affects of the alternatives to the remaining species, they have been grouped by the type of habitat they use.

Of the 18 species of birds of conservation concern in BCR 28 that expected to occur on the MNF, ten use primarily mature forest habitats (Table 3.1). Most of the remaining species either use more open woodland, early successional habitats, or a combination of the two. The peregrine falcon has very specific nest site requirements (cliffs/rock faces in the MNF), but forages over a broad variety of habitats.

Information on habitat preferences was used to assess the likely effects of management activities on the species in each habitat group. This analysis will analyze the effects of the proposed spraying on species of concern using forested and brushy/forested habitat, which will be addressed under the "Insect Eaters" section that follows.

Insect Eaters - Animals that eat insects may be affected by spraying insecticides as this may decrease their available food sources. The only insect-eating Regional Forester listed sensitive species that could possibly occur in defoliated or project areas is the eastern small-footed bat. This species occurs near defoliated and some of the proposed treatment areas, and has suitable habitat within these areas. The limiting factor for this species is the loss of habitat. Mist net surveys conducted within the White Sulphur Springs project area in the summers of 2001 and 2004 documented 6 individual small-footed bats, two of which were found within areas 13 and 16 of the proposed project area. It is not likely that this species eats moths as large as the gypsy moth, but it does eat some smaller moth species, as well as other flying insects, such as flies and mosquitoes.

Many species of songbirds also eat insects and caterpillars in particular, including those Birds of Conservation Concern that use forest habitats described in Table 3.1. Insects provide needed protein for reproductive adult birds and for developing young.

Amphibians, such as salamanders, are another group that rely on insects as food sources.

Hard Mast Consumers - Species that consume hard mast are at risk from defoliation and mortality of oak trees caused by the gypsy moth. The Allegheny woodrat is a RFSS that relies heavily on acorns and other hard mast, and may occur in the project area. The limiting factor for this species is the availability of hard mast food source.

Examples of other animals that rely on hard mast on the Monongahela are wild turkey, gray squirrels, along with other small mammals and birds.

Table 3.1 Birds of Conservation Concern (BOCC) on the MNF and Primary Habitats

Forest (deciduous, coniferous, and mixed)	
Kentucky Warbler	Dense understory of mature, humid deciduous forest, wooded ravines, oak-pine or northern hardwood forest
Louisiana Waterthrush	Along streams flowing though heavily wooded valleys, deciduous forest, some hemlock, northern hardwoods
Worm-eating Warbler	Mature deciduous woodland that lacks dense ground cover, mature beech-maple or oak-pine forest
Cerulean Warbler	Mature forest, mixed mesophytic and oak forest below 600 meters in elevation, common in the west part of the state, sparse in the mountains.
Wood Thrush	Mature or near mature deciduous forest, prefers dense shade on forest floor.
Acadian Flycatcher	Mature mixed deciduous forest dissected by small streams and ravines; lower elevations; not in spruce, oak or pine forest; nests over water; more common in the west side of the state.
Yellow–bellied Sapsucker (breeding)	Upland black cherry forest, cut over mature hardwoods, spruce-hardwoods.
Whip-poor-will	Mixed deciduous woods, upland oak-hickory forest, not in spruce, hardwood-pine or hardwood-hemlock, few in northern hardwoods, rare in dense forest. Potential habitat could occur.
Prothonotary Warbler	Swamps (wooded wetlands) and large streams, not in the highlands.
Northern Saw-whet owl (breeding populations)	Spruce and mixed spruce-hardwoods, swampy areas in coniferous forest, high elevations.
Forest openings; woodlands	
Red-headed Woodpecker[1]	Open oak groves with little understory, groves of oaks and grazing lands, Ohio River valley and low elevations in the Allegheny Mountains.
Black-billed Cuckoo	Moist thickets in low overgrown pastures and orchards; also occurs in thicker undergrowth and sparse woodlands.
Olive-sided Flycatcher[1]	Openings in northern spruce forests, such as bogs, old beaver ponds, burned over slash from lumber operations with scattered snags and trees for perches.
Early successional habitats (e.g., young forest, shrubland, wetland, and grassland)	
Golden-winged Warbler[1]	Low, brushy second growth forest and open woodland, pasture lands and power line rights of way at higher elevations.
Prairie Warbler	Young pine forests and brushy scrub, young second growth hardwoods, overgrown pastures, Christmas tree plantations.
Sedge Wren	Wet grass and sedge meadows, nests near surface of water, needs wetlands, grassy marshes
Henslow's Sparrow[1]	Grassy, weed-filled fields, fields of broom sedge and weeds, early years of plant succession.
Cliff (or cliff-like) habitat	
Peregrine Falcon[1]	Nests in cliffs, bridges over water, or high rise buildings in urban areas. Feeds over fields, forest, or urban areas by catching birds during flight.

[1]This is also a Regional Forester Sensitive Species.

Insects - Among the terrestrial insects affected by exposure to *Btk*, lepidoptera larvae are the most likely to be adversely affected (USDA 1995). These species are discussed in the Non-target Lepidoptera section in this EA. Lepidoptera species of most concern are the RFSS butterflies, Diana fritillary and Appalachian grizzled skipper.

Predators - Predatory animals may be affected by gypsy moth and insecticide spraying mostly by effects to the habitat they occupy. The timber rattlesnake has potential habitat within the project area but there are no known rattlesnake dens in the project area. The limiting factor for the rattlesnake is collecting and killing by humans, as well as habitat destruction.

3.7.3 Direct and Indirect Effects

Alternative 1

Insect Eaters - Not implementing gypsy moth suppression may affect species of concern. Most of the birds present on the Forest, including Birds of Conservation Concern, as well as their prey, are somewhat reliant on forested conditions. The no action alternative would allow continued defoliation to occur over several thousand acres, thus making possible some amount of tree mortality which would leave birds fewer places to nest and in the long term, less available prey. Birds that prefer to nest and feed on insects in dead trees would increase.

Under no action, the effects of continued defoliation on salamanders can be detrimental, as tree mortality can open up the forest canopy enough to dry out areas, making them unsuitable for amphibian habitat.

Hard Mast Consumers – There would be no direct effect on the Allegheny woodrat by the no action alternative. However, the indirect effects to the Allegheny woodrat of continued defoliation may be detrimental. Even if mortality of mast trees is not high, the continued defoliation would severely lessen mast production. Woodrats only travel about 300 feet from their nest sites to gather food, so a decrease in food sources in that home range could result in stress and starvation.

Wild turkey, gray squirrels, and other small mammals and birds that rely on hard mast would also be indirectly affected by the continued defoliation of the no action alternative. The amount of mast would certainly be lower in the short term in the project area, and it would continue to decrease with additional defoliation. The long-term decline of oak species would cause some stress for these species, as they would have to move to other areas, find substitute food sources, and compete for the lower mast amounts.

Predators – There would be no direct effect from the no action alternative on timber rattlesnakes, but indirect effects would be opening up the canopy, which, in den areas could be beneficial. Reduction in mast, leading to perhaps a decline in rodent populations may have negative effects on the snake due to a loss of prey. Other more common predators, such as raptors (northern goshawk, also a RFSS) and mammal predators (bobcat, raccoon, weasel, etc.) would also be affected by an indirect loss of prey base.

Alternative 2

Insect Eaters - The Final EIS for Gypsy Moth Management in the United States (1995) states that predators of invertebrates (including bats) are indirectly affected by the effects of gypsy moth defoliation as well as treatments of *Btk*. Gypsy moth defoliation often results in increased tree mortality which may provide additional dead trees and snags with exfoliating bark and cavities that may be used as summer roost sites. Bats dependent on invertebrates are at a higher risk of a reduction in their prey base when *Btk* is used. However, in a two-year post treatment study following moderate defoliation, Sample and others (1994) found that both *Btk* and defoliation produced fewer effects on the food of bats than was observed for areas treated with Dimilin. In addition, no measurable effects are expected to the small-

footed bat in or near the areas treated with Gypchek, since Gypchek only affects gypsy moth larvae.

For this project some individual bats would likely experience a reduction in prey if they are residing and feeding in the area of a *Btk* spray block. However, due to the relatively small size of the proposed treatment blocks, when analyzed on a landscape scale, the bats would be able to move to adjacent unsprayed forested areas and find alternate foraging territory until insect populations return to pre-treatment levels, or they would feed on remaining insect populations that are not affected by *Btk*. Therefore the project should not impact the small-footed bat.

For species of forest songbirds that eat insects, and caterpillars in particular, preliminary data from studies done in West Virginia (McClain, unpublished data) suggest that, while spraying *Btk* did decrease some food sources (lepidopteran species), there was no decreased reproductive success where *Btk* was applied (McClain, pers. comm. 2003).

There is no data to suggest that there is any harm to birds, or other insect eaters, from consuming dead or dying gypsy moth caterpillars because *Btk* does not harm vertebrates. It is unlikely that birds would eat or feed caterpillars killed by *Btk* as birds prefer live prey, and caterpillars killed by *Btk* quickly become somewhat liquid in consistency and lose appeal as a prey item (McClain pers. comm. 2003). The FEIS for Gypsy Moth Management in the United States summarized field studies that examined the effects of treatment on insectivorous birds, when food resources are reduced by the application of *Btk*. This study showed that the effects of reduced food levels on birds from *Btk* are subtle (USDA, 1995)

No effects to amphibians from *Btk* spraying have been seen in studies (Pauley, pers. comm. 2000).

Hard Mast Consumers - There is no direct effects on the Allegheny woodrat by the action alternative, as spraying does not affect mammals. The effects of the action alternative on wild turkey, gray squirrels, and other small mammals and birds that rely on hard mast would be to reduce the amount of defoliation and to retain hard mast, maintaining the suitability of habitat for these animals similar to the existing condition.

Predators - There would be no direct effects on timber rattlesnakes from spraying *Btk*, but indirect effects would be to keep mast available for rodents so that prey would be more readily available than if mast trees die. None of the limiting factors for this species would be affected by the action alternative. Other more common predators, such as raptors (e.g., northern goshawk) and mammal predators (e.g., bobcat, raccoon, weasel, etc.) would be affected in much the same ways as described above.

3.7.4. Cumulative Effects

Other actions having effects on these species may be defoliation on surrounding private lands and on the neighboring George Washington/Jefferson National Forest (GW/Jeff NF), as well as timber harvesting, recreational activities, and agricultural land uses.

Alternative 1

Effects from long-term defoliation, as would occur with the no action alternative, would have measurable effects on non-target species, especially those that depend on hard mast food sources, such as the woodrat.

Alternative 2

Due to the limited application of *Btk* across the White Sulphur Springs suppression project area when compared to these species ranges, there would be no measurable cumulative effects to these species. The action alternatives would have minimal to no effects on the species and guilds analyzed. Any effects would be of smaller scale than those associated with the continued defoliation expected with the no action alternative. The exception to this would be the direct effect on Lepidoptera species associated with *Btk* use. These effects will be discussed in the "Non-target Lepidoptera" section that follows.

Effects Determinations for RFSS

In summary, based on the above affects analysis for the above species; there would be no loss of population viability over the Forest for any of the sensitive species, nor a trend towards federal listing resulting from implementing this action.

Unavoidable Adverse Impacts

There would likely be no unavoidable adverse impacts to other wildlife species of concern from the proposed action.

3.7.4 Irreversible or Irretrievable Commitment of Resources

The proposed action would not lead to any irreversible or irretrievable commitments for other wildlife species of concern.

3.7.5 Consistency with the Forest Plan, Laws, Regulations, and Handbooks

The proposed action is consistent with the 2006 Monongahela National Forest Land and Resource Management Plan, laws, regulations, and handbook direction pertaining to management direction for wildlife species of concern, such as MIS, RFSS, and BCC.

3.8 Threatened, Endangered, and Sensitive Plants

This analysis addresses potential effects on threatened, endangered, and sensitive (TES) plants as part of Issue 2 described in Chapter 1: Effects of gypsy moth *Btk* treatments on non-target organisms. Concerns under this issue include effects on threatened, endangered or sensitive species.

3.8.1 Scope of the Analysis

The spatial boundary for direct and indirect effects on TES plants consists of the proposed treatment blocks (see project area map in EA Chapter 2). This boundary contains all proposed project activities and is the boundary within which all direct and indirect effects will occur. The spatial boundary for cumulative effects on TES plants is the Proclamation and Purchase Unit boundary for the Monongahela National Forest. This is the boundary to which viability requirements are applied by Forest Service directives and the Forest Plan.

The temporal boundary for direct and indirect effects on TES plants is 3 growing seasons after the insecticide application. This is the expected duration of effects on non-target insects, which is the source of most potential effects on TES plants. This temporal boundary is also used for the cumulative effects analysis because the contribution to cumulative effects ends when the direct and indirect effects no longer exist.

3.8.2 Affected Environment

Threatened and Endangered Plants

Four federally-listed threatened and endangered plant species are known to occur on the Monongahela National Forest: running buffalo clover (*Trifolium stoloniferum*), shale barren rockcress (*Arabis serotina*), Virginia spirea (*Spiraea virginiana*), and small whorled pogonia (*Isotria medeoloides*). The likelihood of occurrence for each threatened and endangered plant species was assessed based on historic records supplemented by recent (2007) surveys conducted for a prescribed fire project that is proposed in the same general vicinity as this project. The proposed gypsy moth treatment blocks have not been surveyed in their entirety.

Virginia Spiraea

Virginia spirea is a clonal shrub found on damp, rocky banks of large high-gradient streams (USFWS 1992a). Reproduction is primarily asexual through fragmentation of clones and natural layering. Flowers are visited by insects, primarily beetles, but seed production is low.

Virginia spiraea is known to occur along the Greenbrier River near Anthony. This occurrence is approximately 4 miles from the nearest proposed treatment block. The treatment blocks do not include any large streams that could serve as potential habitat. Therefore; occurrence within the treatment blocks is considered very unlikely.

Running Buffalo Clover

Potential habitat for running buffalo clover typically exists in lightly disturbed forests and woodlands on soils derived from circumneutral geologic features (NatureServe 2006). The Monongahela National Forest is a stronghold for running buffalo clover, with the largest and highest quality populations range-wide occurring on the Forest (USFWS 2007). Most of the Forest's populations are associated with old skid trails, lightly used roads, or other features that cause moderate soil disturbance.

Running buffalo clover reproduces through both vegetative stolons and seed production. The flower must be pollinated by an insect for seed production to occur (USFWS 2007). Bees have been documented visiting running buffalo clover flowers.

The largest treatment block, Area 13, contains some areas of limestone-derived soils that could provide potential habitat. However, surveys that covered part of this area in 2007 did not find any running buffalo clover. The nearest known running buffalo clover occurrence is located about 28 miles north of the northernmost proposed treatment unit.

Small Whorled Pogonia

Habitat preferences for small whorled pogonia are poorly known, but could include a variety of forested habitats. The available literature indicates occurrence in mixed deciduous and pine-hardwood habitats of a variety of ages, often near partial canopy openings (USFWS 1992b).

Small whorled pogonia is primarily self-pollinated. Insect pollination may occur occasionally, but has not been documented (USFWS 1992b).

The only known occurrence of small whorled pogonia on the Forest is located approximately 0.9 miles from one of the proposed treatment units. Because habitat preferences are poorly known, occurrence elsewhere cannot be ruled out. However, occurrence within any of the treatment blocks is considered unlikely given the extreme rarity of this species on the Forest.

Shale Barren Rockcress

Shale barren rockcress is a biennial herb found mainly on shale barrens in a few counties in eastern West Virginia and western Virginia (USFWS 1991). Habitat for this species is extremely rare, with less than 100 acres estimated to exist on the Forest (USDA Forest Service 2006). The recovery plan for this species states that pollinators are not known, though Syrphid flies have been observed visiting the flowers (USFWS 1991). However, the recovery plan goes on to list loss of potential lepidopteran pollinators due to gypsy moth spraying as a possible threat.

All of the known occurrences of shale barren rockcress on the Forest are located within 3.5 miles of the proposed treatment blocks. The closest known occurrence to a proposed treatment block is 0.8 miles away. Shale barren rockcress is not known to occur in any of the treatment blocks, despite shale barrens in the area having been monitored regularly by the West Virginia Division of Natural Resources. All of the shale barren rockcress occurrences on the Forest are associated with the Brallier shale geologic formation, and the proposed treatment areas overlap only about 400 acres of this formation. Therefore, occurrence of shale barren rockcress in the treatment units is considered unlikely.

Regional Forester's Sensitive Plants

Fifty-four plant species are listed as Regional Forester's Sensitive Species on the Monongahela National Forest. The likelihood of occurrence in the project area for each sensitive plant species was assessed based on historic records and presence of potential habitat, supplemented by recent (2007) surveys conducted for a prescribed fire project that is proposed in the same general vicinity. The proposed gypsy moth treatment blocks have not been surveyed in their entirety. The Likelihood of Occurrence document, which is filed in the project record, summarizes the results of the likelihood of occurrence assessment.

One sensitive plant species, Virginia mountain pimpernel (*Taenidia montana*) is known to occur within 200 meters of treatment area 18. No other sensitive plant species are known to

occur in or adjacent to the proposed treatment blocks, but the likelihood of occurrence assessment indicated that 37 other sensitive plant species have the potential to occur in the treatment blocks. Although none of these species are known to occur in the treatment blocks, potential habitat may exist. Therefore, the potential for occurrence cannot be completely ruled out. Including the one species that is known to occur immediately adjacent to the treatment blocks, a total of 38 sensitive plant species could occur in the treatment blocks.

3.8.3 Direct, Indirect, and Cumulative Effects

Threatened and Endangered Plants – Direct and Indirect Effects

The two insecticides proposed for use do not affect plants directly. *Btk* affects only lepidopteran (butterfly and moth) larvae that are feeding at the time of application, and Gypchek only affects gypsy moths. *Btk* could affect plants indirectly if it kills native lepidopterans that pollinate or prey upon plants. Both insecticides would reduce potentially damaging defoliation by the gypsy moth.

Alternative 1 – No Action

Because the No Action alternative would not involve any new activities, and no T&E plant species is likely to occur in the treatment blocks, the No Action alternative would not affect any of the T&E plant species on the Forest.

Alternative 2 – The Proposed Action

Virginia spiraea, running buffalo clover, small whorled pogonia - Because these species are not known to rely on lepidopteran pollinators and they are not likely to occur in the treatment blocks, the proposed action would not affect them.

Shale barren rockcress - Because reliance on lepidopteran pollinators has not been established and occurrence in the treatment blocks is unlikely, the proposed action would not affect shale barren rockcress.

Threatened and Endangered Plants – Cumulative Effects

Because neither alternative is likely to affect threatened and endangered plants directly or indirectly, neither alternative would contribute to the cumulative effects of other actions on threatened and endangered plants within and around the project area.

Threatened and Endangered Plants – Effects Determinations

Alternatives 1 and 2 would have no effect on any of the threatened and endangered plants that are known to occur on the Forest.

Regional Forester's Sensitive Plants – Direct and Indirect Effects

Alternative 1 – No Action

The No Action alternative would not involve any new activities, so it would not directly affect sensitive plants. If any sensitive plants occur in the proposed treatment blocks, they could be indirectly affected by increased sunlight due to gypsy moth defoliation and subsequent tree mortality. Species with a known preference for full sunlight would benefit, while species that prefer a closed tree canopy would be harmed (see Table 1 in the Botany Report for this EA, PF I02). Effects to species that prefer partial sunlight are

uncertain because the extent of canopy opening due to gypsy moth defoliation and mortality cannot be predicted.

The probability of effects occurring and the magnitude of any such effects cannot be estimated due to the lack of known occurrences.

Alternative 2 – The Proposed Action

Because the insecticides proposed for use are not toxic to plants, the proposed treatments would not affect sensitive plants directly. *Btk* could affect sensitive plants indirectly by killing lepidopteran pollinators. Gypchek would not affect pollinators because it only kills gypsy moth caterpillars.

To evaluate the potential indirect effects of *Btk*, the 38 sensitive plant species that could occur in the project area were evaluated to determine whether they rely on lepidopteran pollinators (see Table 1 in the Botany Report for this EA, PF I02). Eight species are known or suspected to be pollinated by lepidopterans, whereas 24 species are not known or suspected to be pollinated by lepidopterans. Pollinator relationships for the remaining six species could not be determined due to lack of information.

Seven of the eight lepidopteran-pollinated species are also known or suspected to be pollinated by other insects. The specific potential lepidopteran pollinators are not known, so it is not possible to determine whether the caterpillars would be feeding at the time *Btk* is applied. If they are not feeding at that time, they would not be killed and the *Btk* application would have no indirect effect on the plants. If the caterpillars are feeding when the *Btk* is applied, they would be killed and the plants would suffer a temporary reduction in their lepidopteran pollinators. Research suggests that populations of native lepidopterans are likely to recover one to three years after treatment (Sample *et al.* 1996, Strazanac *et al.* 2005). This temporary loss of lepidopteran pollinators could lead to reduced seed production, but for these seven plant species it likely would not cause a total loss of seed production because the plants would be pollinated to some extent by other insect species.

One species, sword-leaved phlox (*Phlox buckleyi*), may be primarily lepidopteran-pollinated. Although specific information on pollinators of sword-leaved phlox is lacking, many *Phlox* species are believed to be pollinated primarily by lepidopterans (Strakosh and Ferguson 2005). However, sword-leaved phlox is known to reproduce asexually (Norris and Sullivan 2002), so it probably is not totally dependent on pollinators for population maintenance and expansion. As with the other lepidopteran-pollinated species, the specific pollinators are not known, so we do not know whether the caterpillars would be active when *Btk* is applied. In a worst-case scenario, all the caterpillars of the species that pollinate sword-leaved phlox would be killed and no other insects would be available to pollinate the flowers. Under this scenario, any populations of sword-leaved phlox that may exist in the treatment blocks would suffer a one- to three-year loss of seed production. Existing occurrences of sword-leaved phlox would not be lost because the plants are perennial and could resume seed production when pollinator populations recover. A population decline is unlikely unless some other factor causes mortality of the existing plants.

The six species for which pollinator relationships are not known could be affected if they occur in the proposed treatment blocks and if they have lepidopteran pollinators. The extent of the effect would depend on the extent to which the plants can accommodate other insect pollinators and whether the lepidopteran pollinator larvae are feeding when *Btk* is applied. In a worst-case scenario, the plants could lose seed production for one to three years. All but one of these species is perennial; these plants would persist and resume seed production when pollinator populations recover. A population decline is

unlikely unless some other factor causes mortality of the existing plants. Spreading rockcress (*Arabis patens*) is a biennial and thus is dependent on regular seed production to maintain the population. In the worst-case scenario, spreading rockcress could experience a temporary drop in the number of individuals due to the loss of one to three years of seed production. Seed longevity for spreading rockcress is unknown, but other *Arabis* species are known to form persistent seed banks (Holzel and Otte 2004a, Holzel and Otte 2004b, Allen and Nowak 2008). If spreading rockcress forms a similar seed bank, populations could recover quickly from a short-term loss of seed production.

The 24 sensitive plant species that are not known or suspected to be lepidopteran-pollinated likely would not be affected by the proposed action.

Because no sensitive plant species is known to occur within the treatment blocks, all of the effects outlined above should be considered potential effects that are not certain to occur. Lack of known occurrences makes it impossible to estimate the probability that such effects would actually occur or estimate the magnitude of any such effects. However, based on the likely quick recovery of lepidopteran populations, any occurrences of sensitive plants that may be present are not likely to be extirpated.

Regional Forester's Sensitive Plants – Cumulative Effects

Alternative 1 – No Action

Continued defoliation by gypsy moths under the No Action alternative could affect any of the sensitive plant species with the potential to occur in the project area. Five of these species could be affected by other ongoing and proposed projects on National Forest land. As noted below, rock skullcap would be affected by two other projects and Appalachian blue violet would be affected by five other projects. In addition, Canada yew (*Taxus canadensis*), Kate's Mountain clover (*Trifolium virginicum*), and lance-leaved buckthorn (*Rhamnus lanceolata*) could be affected by the Forest-wide Nonnative Invasive Species Management project. The nonnative plants project could have both beneficial and detrimental effects on Canada yew, whereas effects on Kate's Mountain clover and lance-leaved buckthorn are expected to be beneficial. Effects of gypsy moth defoliation likely would benefit Kate's Mountain clover and lance-leaved buckthorn, but likely would harm Canada yew. The effects of defoliation on rock skullcap and Appalachian blue violet would depend on the extent of long-term canopy openings created by mortality.

Because the potential direct and indirect effects of the No Action alternative are not certain to occur and the magnitude of any such effects cannot be predicted, any potential contribution to cumulative effects cannot be measured. For these five species, no population is expected to be extirpated, and several populations are expected to continue to exist after implementation of the projects that would affect these species. Therefore, population viability would not be compromised.

Alternative 2 – The Proposed Action

The Proposed Action could have adverse effects of unknown magnitude on 14 sensitive plant species. If such adverse effects occur, they would contribute to the cumulative effects of other past, present, and reasonably foreseeable future actions. While past land management activities on both private and National Forest land likely had a variety of adverse effects on these species, the specific effects of specific activities are not known. Ongoing and future activities on National Forest land are likely to affect two of these species: rock skullcap (*Scutellaria saxatilis*) and Appalachian blue violet (*Viola appalachiensis*).

Rock skullcap would be affected by the proposed Ramshorn prescribed fire project and the proposed Forest-wide Nonnative Invasive Species Management project. These projects are not expected to cause substantial population reductions and are not expected to extirpate any occurrences.

Appalachian blue violet is likely to be affected by five other ongoing and future activities on National Forest land: the ongoing Upper Williams timber project, the proposed Hogback timber project, the ongoing Upper Williams wildlife habitat improvement project, the ongoing Upper Williams watershed improvement project, and the Nine Gas Pipeline project. These activities may impact individuals, but because Appalachian blue violet is a disturbance-adapted species, the occurrences are not expected to be extirpated.

Because the potential direct and indirect effects of the Proposed Action are not certain to occur and the magnitude of any such effects cannot be predicted, any potential contribution to cumulative effects cannot be measured. For both rock skullcap and Appalachian blue violet, numerous populations are expected to exist after implementation of the projects that would affect these species, so population viability would not be compromised.

Effects Determinations

Alternative 1 – No Action. Any sensitive plant species that could occur in the project area could be affected by the change in light regime caused by continued gypsy moth defoliation. Some species would benefit, others would be harmed, and for many species, the direction and magnitude of potential effects is uncertain. However, no population is expected to be extirpated. Therefore, for the following 38 species, the No Action alternative may impact individuals, but is not likely to lead to loss of viability or a trend toward federal listing:

Allegheny onionTurgid gay feather
Lillydale onionCanada mountain rice grass
Spreading rockcressSilver nailwort
Blue wild indigoCanby's mountain lover
Lance-leaf grapefernSwamp lousewort
Blunt-lobed grapefernSword-leaved phlox
Foliose lichenBog bluegrass
Bentley's coral rootBeadle's mountainmint
Roundleaf dogwoodLance-leaved buckthorn
Small yellow lady's slipperRock skullcap
Showy lady's slipperVirginia mountain pimpernel
Shale barren wild buckwheatCanada yew
Box huckleberryAppalachian bristle fern
Appalachian oak fernNarrow-leaved blue-curls
Sweet-scented Indian plantainKate's mountain clover
White alumrootNodding pogonia
Blue Ridge St. John's wortAppalachian blue violet
ButternutSand grape
Highland rushNetted chain fern

For all other sensitive plant species on the Forest, the No Action Alternative would have no impacts.

Alternative 2 – The Proposed Action. Based on the analysis above, 14 sensitive plant species could be present and could be affected indirectly through effects on pollinators. No populations of these plants are expected to be extirpated. Therefore, for these 14

species, the Proposed Action may impact individuals, but is not likely to lead to loss of viability or a trend toward federal listing:

Allegheny onion	Turgid gay feather
Spreading rockcress	Silver nailwort
Roundleaf dogwood	Canby's mountain lover
Shale barren wild buckwheat	Sword-leaved phlox
Sweet-scented Indian plantain	Beadle's mountainmint
White alumroot	Rock skullcap
Blue Ridge St. John's wort	Appalachian blue violet

For all other sensitive plant species on the Forest, the Proposed Action would have no impacts.

Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to the TES plants from proposed activities under either Alternative 1 or 2.

3.8.4 Irreversible or Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of the TES plants or their habitats in the project area due to method of the application of the pesticides (aerial application) and the nature of the composition of the pesticides being used in the project.

3.8.5 Consistency with the Forest Plan, Laws, Regulations, and Handbooks

All alternatives would be implemented consistent with Forest Plan goals, objectives, standards, and guidelines as explained in the Standards and Guidelines of the Forest Plan for the Botanical Resources and Pesticide Management (Monongahela National Forest Land and Resource Management Plan, pp. II-17 through II-28).

All alternatives would be implemented consistent with Forest Service laws, regulations, and handbooks regarding management of the botanical resources.

3.9 Non-target Lepidoptera

This analysis addresses potential effects to the non-target Lepidoptera (moths and butterflies) as part of Issue 2 described in Chapter 1: Effects of gypsy moth *Bacillus thuringiensis* var. *kurstaki* (*Btk*) treatments on non-target organisms. Concerns under this issue include impacts to moths and butterflies other than gypsy moth, all of which are in the order Lepidoptera.

3.9.1 Scope of the Analysis

The spatial boundary used to evaluate direct, indirect, and cumulative impacts of gypsy moth defoliation are within the areas defoliated in both 2007 and 2008. The spatial boundary used to evaluate direct, indirect, and cumulative impacts for *Btk* are the specific treatment blocks. This area was selected because the affects of aerial spraying on non-target Lepidoptera with *Btk* is limited only to the area directly being treated.

The temporal boundary used to evaluate direct effects will be 2-10 days, which is the time that *Btk* is generally known to directly affect feeding Lepidoptera following its application. The temporal boundary for indirect and cumulative effects is will be 0-2 years, which is the time that studies have shown that *Btk* may have residual effects on Lepidoptera.

3.9.2 Affected Environment

During the summer of 2008, aerial surveys performed by the Forest Service and the State of West Virginia identified 23,419 acres of forest defoliated by the gypsy moth within the Monongahela National Forest proclamation boundary. This is a dramatic increase from the 7,811 and 724 acres mapped in 2007 and 2006, respectively. Many of the areas defoliated in 2008 also experienced some level of defoliation in 2007. In a hardwood forest, about 30 percent of the leaves must be eaten for the defoliation to become noticeable during an aerial survey. Tree defoliation and subsequent mortality can alter wildlife habitats, change water quality and temperature, increase forest floor temperatures and light levels, and reduces aesthetic and recreational values, all of which conflict with existing resource management objectives.

The Forest Service proposes to treat an estimated 13,140 acres of National Forest System lands in 12 separate treatment blocks for the control of gypsy moth in 2009. The proposed treatment area is located on the Marlinton/White Sulphur Ranger District of the Monongahela National Forest, in Greenbrier and Pocahontas Counties. These suppression treatments would consist of the following: one aerial application of the bacterial insecticide *Btk* on 5,224 acres; two applications of *Btk* on 7,445 acres; and two applications of Gypchek, the gypsy moth specific biological insecticide, on 471 acres. Treatments would occur during a two-week period in early to mid May of 2009. The exact dates would depend on the progress of leaf growth and gypsy moth larval development.

Btk is a bacterium that has insecticidal activity only against caterpillars of moths and butterflies. *Btk* must be ingested by caterpillars, is short-lived in the environment (2-10 days), and only directly affects caterpillars on foliage at the time of application or shortly thereafter. *Btk*, when applied to foliage, is ingested and results in gut paralysis of the insect larvae, causing them to starve and die (USDA 1995). The application of *Btk* would occur in several units that contain suitable habitat for the Diana fritillary and Appalachian grizzled skipper, two Regional Forester Sensitive Species on the Forest. Thus it is possible that these species could occur within the proposed treatment areas.

3.9.3 Direct, Indirect, and Cumulative Effects

Alternative 1 – No Action

Direct and Indirect Effects - Heavy widespread and prolonged defoliation by the gypsy moth might be expected to reduce Lepidoptera diversity, at least temporarily (USDA 1995, Vol. IV). If no insecticide is applied and defoliation occurs, gypsy moth larvae may affect native lepidopterous larvae by competing directly with native species for available foliage (Sample *et al.* 1996).

Tree host defenses triggered by defoliation decrease the nutritional value of the leaves and may adversely influence the survival of many native Lepidoptera species (USDA 1995, Vol. IV). Also, some of the principle parasitoids introduced to combat the gypsy moth have a broad host range and attack numerous species of native lepidopterous larvae. These parasitoids were introduced into areas of gypsy moth defoliation many years ago and are still present at typically low levels. In areas where elevated gypsy moth populations could result in an increased abundance of parasitoids, such parasitoids could reduce populations of some of these alternate hosts to very low levels (USDA 1995, Vol. IV).

Cumulative Effects - Effects due to the gypsy moth would be cumulative in situations of repeated outbreaks and defoliation in the same areas. Repeated defoliations would lead to changes in forest conditions that are characterized by increased tree mortality, stand structure and composition changes. Following defoliation, many investigators noted increases in red maple and other species, and corresponding decreases in oak in Appalachian forests (USDA 1995, Vol. IV). Some of the lepidopteran species that require oak dominated forest canopies could decline, which could sooner or later lead to local extinction of species with inferior competitive ability (e.g., rare or protected species). Other species may increase in response to the increased plant diveristy and more open stand conditions.

Alternative 2 - The Proposed Action

Direct and Indirect Effects – Because *Btk* must be ingested by caterpillars, is short-lived in the environment (2-10 days), and only directly affects caterpillars on foliage at the time of application or shortly thereafter, permanent changes in non-target caterpillar populations are not likely following suppression (USDA 1995, Vol. 1). In a three-year study in eastern West Virginia with one application of *Btk* at 24 Billion International Units per acre (BIU/ac), researchers found a significant reduction in the abundance and numbers of non-target caterpillar species in the treatment year but not the following year (Sample *et al.* 1996). Another study documented full recovery of non-target spring caterpillars within 1 or 2 years after treatment (Strazanac and Butler 2005). While some non-target lepidopteran species are very sensitive to *Btk*, other lepidopteran larvae's sensitivity to *Btk* is highly dependent on their developmental stage. This is particularly evident for the cinnabar moth, where late instar larvae are very sensitive to *Btk* and early instar larvae are very tolerant to *Btk* (James *et al.* 1993). The variability in response of non-target Lepidoptera to *Btk* is also illustrated in a recent field study conducted in two forests over a two-year period, at an application rate of 16 BIU/ac. Results showed that the response of non-target Lepidoptera varied substantially among different species. Larvae of three Lepidoptera decreased in treatment years, but for 19 other species larval counts were significantly higher (Rastall *et al.* 2003).

Field studies on the indirect effects of *Btk* on the rates of parasitism on gypsy moth and other Lepidoptera have yielded somewhat variable results (USDA 1995, Vol. IV). Some predators and parasitoids may be affected indirectly by *Btk* because of the loss of gypsy moth and other caterpillars they parasitize or eat. Two parasitic wasps actually increased their rates of parasitism on gypsy moth in areas treated with *Btk.* Larvae that ingest *Btk* feed at a lower rate, thus prolonging their larval period and allowing greater time for the development of the parasite (USDA 1995, Vol. IV).

Therefore, although *Btk* treatment could kill the Diana fritillary in the proposed treatment areas if the larvae were present and feeding, the Diana fritillary would be expected to revert back to their pre-treatment numbers over a relatively short period.

Due to the known occurrence of the Appalachian grizzled skipper near the southernmost treatment areas (21, 22, and 28), Gypchek will be used in those areas instead of *Btk*. Gyphcek is a formulation of the nucleopolyhedrosis virus (NPV), a naturally occurring pathogen of the gypsy moth. It only kills gypsy moth and is used primarily to reduce high-density populations. NPV is not expected to put any group of organisms at risk of mortality, other than gypsy moths, due to its specificity (USDA 1995, Appendix G). Applications of Gypchek would not impact terrestrial organisms, other than the gypsy moth, in any way. Therefore, the grizzled skipper would not be affected by the propose action.

Cumulative Effects - Many studies indicate that *Btk* lasts about a week in the environment (SERA 2004). Repeated treatments of the areas with *Btk* could potentially impact some species of spring feeding Lepidoptera. If the Forest Service achieves its objective to reduce gypsy moth populations so that treatment will not be needed the following year, *Btk* will not be applied to these areas in 2010. Since *Btk* is not used in the same spray block with other treatments (e.g. Dimilin), there is no cumulative effect between different treatments and *Btk* on non-target Lepidoptera. There are also no cumulative effects associated with Gypchek application in the project area, as Gypchek is not known to affect any other Lepidoptera than gypsy moth.

Unavoidable Adverse Impacts

Based on the analysis above, any unavoidable impacts from *Btk* application to non-target Lepidoptera would likely be low in intensity and relatively brief in duration.

3.9.4 Irreversible or Irretrievable Commitment of Resources

Irreversible commitments are those that cannot be reversed (e.g., when a species becomes extinct), except perhaps in the extreme long term (e.g., removing an old growth forest). Irretrievable commitments are those that are lost for a relatively long period of time. It is doubtful that either alternative would lead to any irreversible commitment of natural resources. However, if the no action alternative is selected, some mature tree mortality would probably occur. This could be considered irretrievable since it takes eastern hardwood forests to grow to maturity in 80 to 100 years.

3.9.5 Consistency with the Forest Plan, Laws, Regulations, and Handbooks

The proposed action is consistent with the 2006 Monongahela National Forest Land and Resource Management Plan, laws, regulations, and handbook direction pertaining to management direction for treatment of non-native pests, which allows treatment to help control insect or disease outbreaks.

3.10 Aquatic and Riparian Resources

Although there was no direct issue related to aquatic and riparian resources in Chapter 1, effects to soil and water quality (Issue 3) and tree vegetation (Issue 1) may also have effects to aquatic organisms and habitats, as well as riparian habitat, due to the close relationships between these resources. Therefore, this section addresses potential impacts to aquatic and riparian resources.

3.10.1 Scope of Analysis

Proposed gypsy moth suppression treatments on NFS lands would occur in select locations of eight sub-watersheds (6th level Hydrologic Unit Codes – HUCs) in the Greenbrier River drainage (see Figure 3.1). Potential direct effects to aquatic and riparian resources associated with this proposal would be confined to the areas receiving actual treatment. Potential indirect effects to aquatic and riparian resources may extend beyond the actual treatment blocks but would not reasonably be expected to occur or be detectable beyond the extent of the eight sub-watersheds that possess proposed treatment blocks. Where potential direct and indirect effects from proposed gypsy moth treatments overlap effects from other past, present, and reasonably foreseeable activity, cumulative effects may occur. Therefore, the area of analysis for cumulative effects is confined to the eight sub-watersheds where gypsy moth suppression treatments are proposed on NFS lands.

The analysis period considers short-term and long-term effects associated with proposed gypsy moth suppression treatments. Short-term effects were generally considered to be the duration of persistence for the proposed applications of insecticide. Information from Norris *et al.* (1991), product labeling, and the Final Environmental Impact Statement for Gypsy Moth Management in the U.S. (USDA 1995) suggests the proposed insecticide applications would likely be rendered ineffective within a period of days to two weeks.

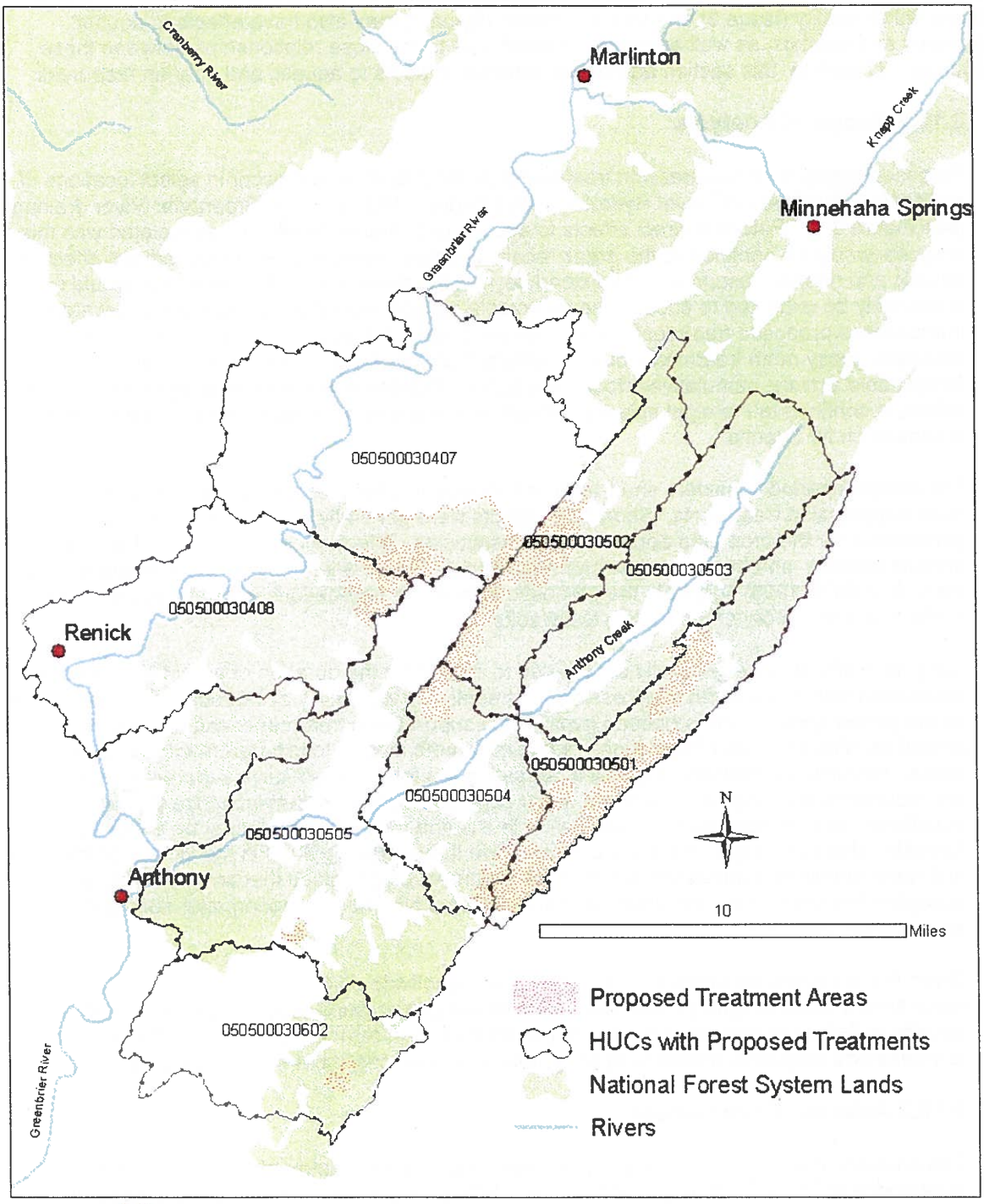
Long-term effects were generally considered to extend for the duration of potential indirect effects associated with gypsy moth suppression treatments. The duration of indirect effects was defined as the period between the proposed gypsy moth suppression treatments and the return of potentially affected insect populations (*e.g.* gypsy moth larvae) to pre-treatment or outbreak levels. Recurrence intervals of gypsy moth outbreaks following effective suppression treatments are reported to be variable. There are many confounding factors that influence the rate of population rebound following low population levels and these factors cannot be accurately forecast. However, gypsy moth populations were treated during 2003 in the vicinity of this project and have remained suppressed within these treatment blocks since that time. It is generally accepted that population rebounds can occur within a 5 to 10 year period after successful suppression treatments.

Given the expected persistence of the proposed insecticide applications and the anticipated recurrence interval of gypsy moth outbreaks following population suppression, analyses for aquatic and riparian resources generally considered short-term effects to be on the order of days to weeks and long-term effects to approximate a 10 year post-treatment time frame.

3.10.2 Affected Environment

The analysis area for the proposed gypsy moth suppression treatments consists of eight sub-watersheds (6th level Hydrologic Unit Codes – HUCs) in the Greenbrier River drainage. These subwatersheds are depicted in Figure 3.1 and listed in Table 3.2 along with their identifying HUC, total watershed acres, acres of National Forest System (NFS) lands, and the percent of watershed acres in NFS lands. National Forest System lands account for 54.5 percent of the analysis area overall but range between 16 and 94 percent of the individual subwatersheds.

Figure 3.1 Map of the Analysis Area for Aquatic and Riparian Resources



"Original data were compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. This map has no warranties as to its contents or accuracy."

Table 3.2 Land Ownership in 6th Field Hydrologic Units Codes (HUCs)

Subwatershed Name	6th Field HUC	Total Acres	NFS Acres	% NFS Lands
Locust Creek-Greenbrier River	050500030407	36,314	5,825	16.0
Slabcamp Run-Greenbrier River	050500030408	26,126	11,344	43.4
Meadow Creek	050500030501	15,184	14,144	93.2
North Fork Anthony Creek	050500030502	14,262	13,368	93.7
Upper Anthony Creek	050500030503	20,974	16,127	76.9
Middle Anthony Creek	050500030504	13,210	9,304	70.4
Lower Anthony Creek	050500030505	30,986	18,956	61.2
Headwaters Howard Creek	050500030602	17,022	5,861	34.4

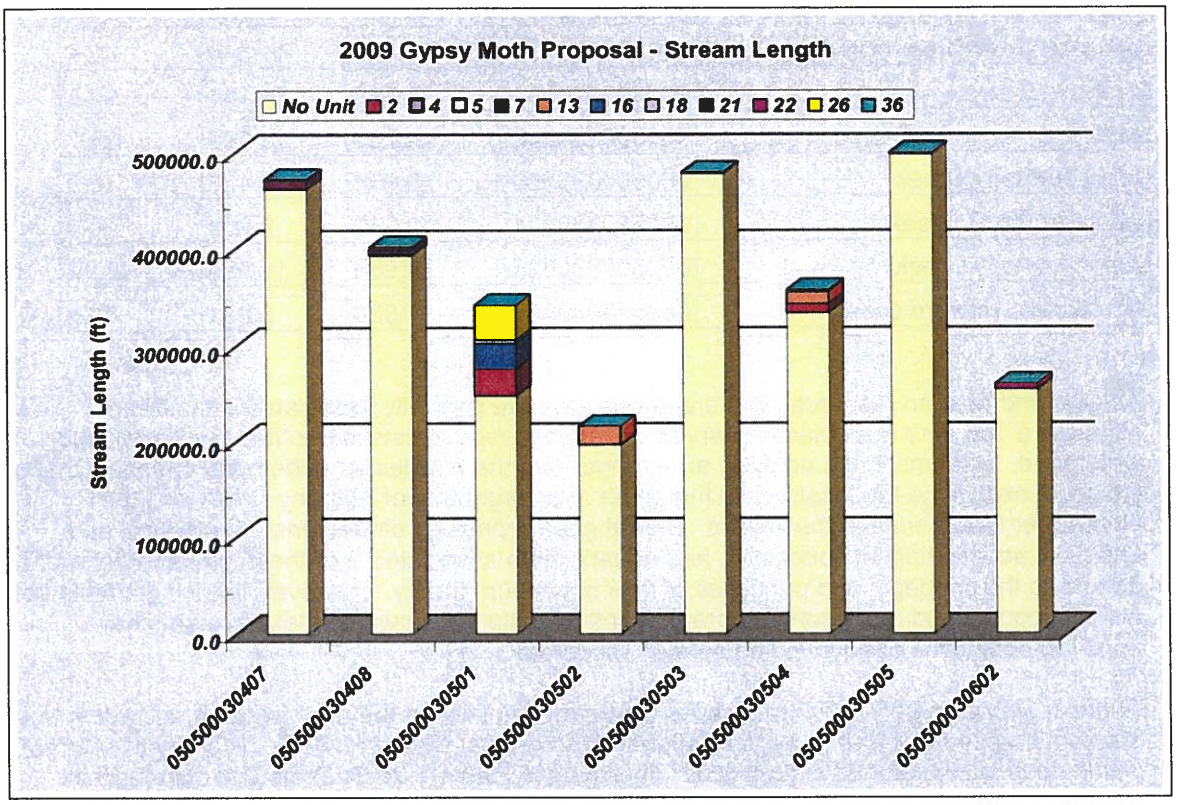
Aquatic and riparian resources in the analysis area are primarily associated with streams although a 166 acre man-made reservoir, Lake Sherwood, exists in the Meadow Creek sub-watershed. Streams in the analysis area range from the smallest of ephemeral channels that are typical of near ridge top locations to the larger river segments of Anthony Creek and the Greenbrier River found in the valleys. Fluvial geomorphology characteristics, physical and chemical aquatic habitat conditions, and aquatic biota associated with these streams generally adhere to the concepts and principles of river continuum theory. However, lingering effects from historic logging and more contemporary agents of disturbance within these systems have impaired conditions of aquatic and riparian resources.

There is approximately 1,215 total miles of stream identified in the analysis area according to streams mapped at 1:24000 by the National Hydrography Dataset (NHD). The length of stream within each subwatershed is graphically displayed in Figure 3.2. Streams that occur within treatment subwatersheds but outside the actual areas proposed for gypsy moth suppression treatments represent nearly 95 percent of the total length of stream in the analysis area. At 28 percent, the Meadow Creek subwatershed possesses the greatest proportion of streams within proposed gypsy moth treatment blocks. Other subwatersheds have between 0.3 and 9 percent of their stream length within the proposed treatment blocks.

Riparian habitat in the analysis area was quantified by establishing 100-foot buffers along each side of streams contained in the NHD. These stream channel buffers likely overestimate the extent of the riparian area in some areas but underestimate it in other areas. Land cover data from the 2002 West Virginia University GAP analysis was used to quantify the amount of forested stream channel buffers within the areas proposed for gypsy moth treatments. This analysis indicates that 794 acres of the 797 acres of stream channel buffers (99.6%) within the proposed treatment blocks are forested. The proportionate area of stream channel buffers that are forested is greater than 99 percent in proposed treatment blocks 2, 4, 5, 7, 13, 18, 21, 26, and 36. The percentage is between 98 and 99 percent in proposed treatment blocks 16 and 22. At 98 percent, the Headwaters Howard Creek (050500030602) is the only subwatershed that has less than 99 percent forested stream channel buffer within the proposed gypsy moth treatment blocks.

Aquatic communities in the analysis area vary in association with the range of stream and riparian characteristics – stream size and other aquatic habitat components. Several streams in the analysis area support native cold-water biota typically associated with brook trout (*Salvelinus fontinalis*) communities. Other stream reaches are transitional areas better suited for cool-water aquatic assemblages that are characteristic of smallmouth and rock bass communities. These cool-water transitional streams may not support cold-water biota during much of the year but they can offer important seasonal habitat for cold-water biota, such as during winter months.

Figure 3.2. Stream Length Associated with Proposed Gypsy Moth Treatments on NFS lands and Stream Length Outside of Proposed NFS Treatment Blocks. (Data is displayed by individual subwatersheds that comprise the analysis area)



Recent updates to fish species distribution on the Monongahela National Forest (Welsh and Cincotta 2007) indicate there are 47 fish species inhabiting the analysis area (see Appendix C in Aquatic Resources Report in Project File). These species represent the Anguillidae (eels), Cyprinidae (minnow), Catostomidae (sucker), Ictaluridae (catfish), Salmonidae (trout), Centrarchidae (bass), Cottidae (sculpin), and Percidae (perch) fish families. Of the 47 fish species that inhabit the analysis area:

- 44 species are native to the Greenbrier River drainage,
- candy darter (*Etheostoma osburni*) and New River shiner (*Notropis scabriceps*) are listed as Regional Forester's Sensitive Species,
- candy darter, New River shiner, and bigmouth chub (*Nocomis platyrhychus*) are endemic to the New River system,
- mountain redbelly dace (*Phoxinus oreas*) is a disjunct species, and
- brook trout (*Salvelinus fontinalis*) is the Forest's only aquatic Management Indicator Species (MIS).

Aquatic macro-invertebrate communities within the analysis area are equally variable in composition depending on site specific stream characteristics. Aquatic species that are federally listed under the Endangered Species Act (ESA) are not known to occur in the analysis area.

3.10.3 Direct, Indirect, and Cumulative Effects

Effects Common to All Alternatives

Aquatic and riparian resources within the analysis area would be expected to continue a gradual recovery trend from the lingering effects associated with historic timber harvesting activities. Effects associated with most other on-going disturbance mechanisms as well as forecast environmental changes associated with global warming would also remain unaffected by the alternatives for this project. For aquatic and riparian resources, the difference in effects between the no action and the action alternatives would primarily be related to the temporary suppression of outbreaks of gypsy moth populations. These differences are highlighted in the discussion for each alternative. Other considerations for streams, riparian areas, floodplains, wetlands, water quality, and associated aquatic communities are expected to be unaltered by the alternatives for this project.

Alternative 1 – No Action

Direct and Indirect Effects - The No Action alternative would not allow targeted areas of gypsy moth infestations on NFS lands to be treated with *Btk* or Gypchek to suppress observed population outbreaks. Since no action would be taken under this alternative, there would be no direct effects to aquatic and riparian resources.

Indirect effects to aquatic and riparian resources of not treating gypsy moth populations would largely depend on the severity of gypsy moth outbreaks within the proposed treatment blocks. The nature of potential effects to aquatic and riparian resources from gypsy moth outbreaks has been described in the Final Environmental Impact Statement for Gypsy Moth Management in the U.S. (USDA 1995) and is included by reference here. Of these effects, the primary concern for aquatic and riparian resources is gypsy moth defoliation of trees in riparian areas and potential ramifications to stream temperatures, riparian forest health, aquatic macro-invertebrate communities, and the balance of terrestrial contributions to energy budgets associated with aquatic food webs. Changes to any of these conditions may be important considerations. However, the fundamental concern for aquatic and riparian resources under this alternative is the potential long-term consequences to riparian forest health and the associated impacts that can result from persistent forest defoliation and eventual tree mortality (such as increases to stream temperatures).

Cumulative Effects - If gypsy moth populations do not continue along what appears to be a cycle of population outbreak levels based on 2008 assessment data, cumulative effects of the No Action alternative would not be expected to deviate substantially from conditions that exist today. If the apparent outbreak level of gypsy moth populations persists within the proposed treatment blocks, indirect effects described previously would contribute to on-going cumulative effects and adversely impact aquatic and riparian resources. The degree of adverse affects would depend on the extent and duration of forest defoliation within riparian areas.

Alternative 2 – The Proposed Action

Direct and Indirect Effects - Alternative 2 consists of the proposed action as described in Chapter 2 of this EA. The application of *Btk* and Gypchek to suppress gypsy moth populations carries some risk for adverse effects to aquatic biota. However, direct and indirect effects associated with this alternative have a greater potential to help protect favorable conditions and trends for aquatic and riparian resources.

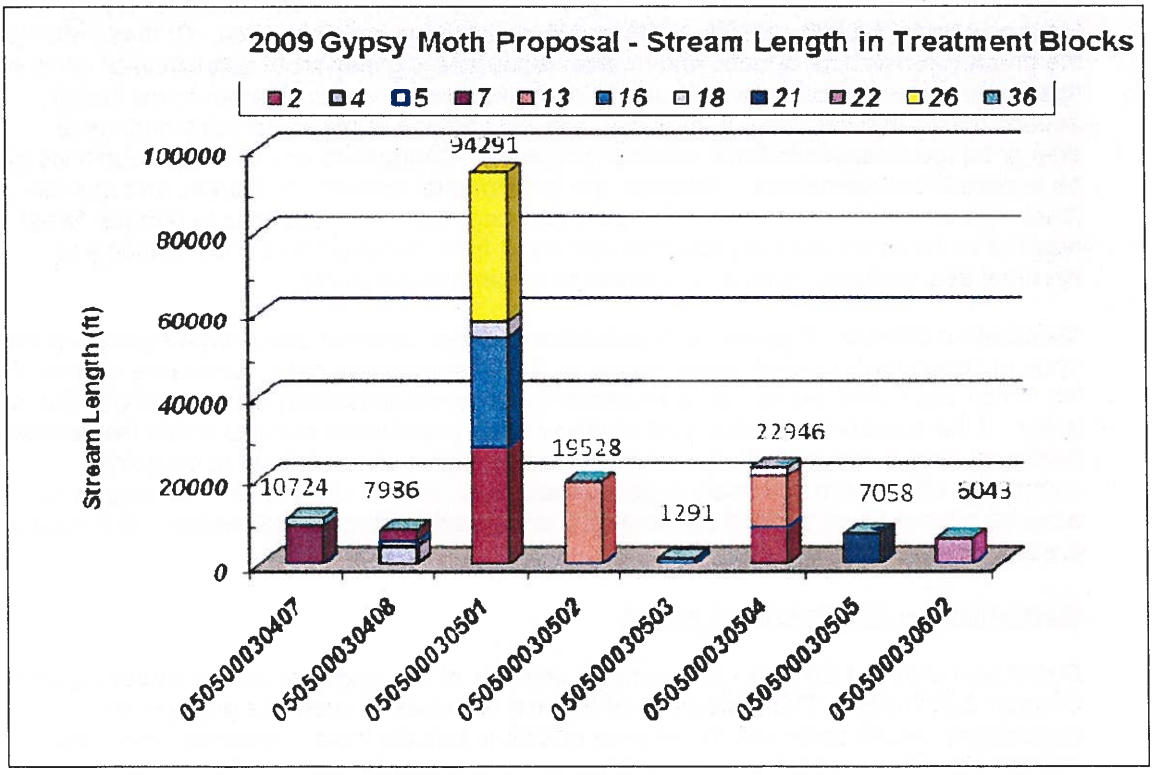
This alternative would result in aerial spraying of *Btk* or Gypchek to forested areas that possess an estimated 32 miles of mapped streams. Additional miles of unmapped streams likely occur within the proposed treatment blocks. Stream systems that occur within the

treatment blocks on NFS lands area identified in Table 3.3 according to the 6th field HUC in which they occur. The length of mapped streams within the individual proposed treatment blocks is graphically displayed by 6th field HUC in Figure 3.3. Aquatic and riparian resources in these streams are subject to direct effects from this alternative. Other aquatic and riparian resources within the analysis area that are connected to these streams are subject to indirect effects.

Table 3.3 Stream Systems within Proposed Treatment Blocks on NFS Lands

Watershed Name	6th Level HUC	Stream Systems in Treatment blocks
Locust Creek-Greenbrier River	050500030407	Spice Run
Slabcamp Run-Greenbrier River	050500030408	Davy Run, Kincaid Run, Slabcamp Run
Meadow Creek	050500030501	Dilley Run, Laurel Run
North Fork Anthony Creek	050500030502	Onemile Run, Twomile Run, Fourmile Run
Upper Anthony Creek	050500030503	unnamed headwater streams
Middle Anthony Creek	050500030504	Wiley Run, Humphreys Draft, Stony Run, Sharp Hollow
Lower Anthony Creek	050500030505	Little Creek
Middle Anthony Creek	050500030504	Simms Run
Headwaters Howard Creek	050500030602	Sulphur Lick Run, Pond Lick Run, Jerico Draft

Figure 3.3 Length of Mapped Streams within Individual Proposed Treatment Blocks by 6th Field HUC



It is anticipated that the proposed applications of *Btk* and Gypchek would suppress gypsy moth populations in a manner that would help prevent defoliation of forested riparian areas in the treatment blocks. These forested riparian habitats help protect against thermal loading in

streams by providing stream shade. This function of forested riparian areas is important for sustaining more favorable stream temperature regimes for aquatic communities associated with these stream systems. Forested riparian areas are also important sources of allochthonous inputs and periodic woody debris recruitment to streams. Current conditions and gradual recovery trends for aquatic and riparian resources in the analysis area would be expected to continue as a result of this alternative. However, this alternative carries some risk for aquatic communities in the analysis area.

Risks for adverse effects to aquatic biota under this alternative are largely associated with the potential for pesticide treatments to increase mortality rates for populations of non-target aquatic macro-invertebrates. Larvae of aquatic lepidopterans, blackflies (family Simuliidae) and two species of stoneflies (in the families Leutridae and Taeniopterygidae) are reported to be susceptible to *Btk* at field applications rates (USDA 1995). If non-target aquatic organisms succumb to potential lethal effects of the treatment pesticides, the balance and flow of energy through the food web could be disrupted in a myriad of ways that involve consequences to other aquatic organisms in these communities. The result of this could consist of decreased productivity for the affected stream systems.

Proposed pesticide applications under this alternative could have the unwanted direct effects of increasing the mortality of non-target aquatic insects and associated indirect effects of reduced productivity in affected streams. However, risks for adverse effects to aquatic resources are expected to be small. This is partly due to the characteristic behavior of the treatment pesticides in the natural environment and partly due to the spatial context of the targeted treatment blocks.

Various studies have examined the behavior of gypsy moth pesticides under a variety of conditions (USDA, 1995). Norris *et al.* (1991) report on studies that examined the persistence of an assortment of pesticides in soil and water. This report indicates that only 50 percent of an initial application of *Bacillus thurigiensis* (*Bt*) applied to foliage persisted beyond 3.9 days when exposed to cool, cloudy conditions and 7.7 days when exposed to hot, sunny conditions. Product labeling for *Btk* suggests repeat applications may be needed every 3-14 days to maintain control of pests. No such information was reported in Norris *et al.* for Gypchek. However, product labeling states that Gypchek is sensitive to environmental conditions and suggests repeat applications 2 to 4 days apart if necessary for effective control. Given this, it is likely that direct effects of the proposed insecticide treatments would be confined to a period of days to weeks following pesticide application, depending on environmental conditions.

The spatial extent and characteristics of streams that could be directly impacted by the proposed pesticide treatments are other important considerations when evaluating risks to aquatic and riparian resources. With few exceptions (such as Laurel Run in the Meadow Creek sub-watershed), streams in the direct path of proposed pesticide spraying are small perennial streams, intermittent streams, or ephemeral headwater streams that are well-distributed throughout the analysis area. In addition, the proportionate length of stream being proposed for treatment in any one 6th field HUC is between 0.3 and 9 percent. The exception to this is in the Meadow Creek subwatershed where 28 percent of the stream length is within the treatment blocks. This information suggests that even if direct adverse effects were to materialize for aquatic biota under this alternative, they would primarily be confined to a small headwater portion of a particular stream system. These areas would be expected to recovery from such impacts within one to two years should they occur.

However, as noted in the Affected Environment section, more than 99 percent of the total stream length that would be susceptible to direct impacts from pesticide spraying is surrounded by a canopied forest. Though the effective bacterial and viral components contained in *Btk* and Gypchek occur naturally and can persist at low levels for a longer duration in soils, the persistence of these pesticides is severely limited following application to

foliage in forested environments. Proposed pesticide spraying would occur when tree leaves in the treatment blocks are 30 to 40 percent developed. Therefore, the characteristic forested canopy associated with riparian areas within the proposed treatment blocks is expected to serve as a layer of protection against the introduction of viable pesticides into live streams.

There is some uncertainty about the level of metals in the aqueous surfactant mixture, CARRIER 038-A, used to help disperse the active pesticide material. The label indicates "All metals are suspected to be at extremely low levels" so risks to aquatic biota and water quality associated with metal contamination may be low.

Cumulative Effects - Cumulative effects of the Proposed Action (Alternative 2) would not be expected to deviate substantially from conditions that exist today. This is because the proposed actions are intended and expected to result in perpetuating desirable existing conditions for forest vegetation. Adverse effects to aquatic biota are possible, particularly in the event that an accidental spill reaches live streams. However, such accidental spills are rare and unlikely to occur. Other potential adverse affects to aquatic and riparian resources would be limited in scope and duration if they were to materialize.

Selection of this alternative may increase the effectiveness of gypsy moth suppression efforts throughout the analysis area. Actions being proposed under this alternative may compliment similar efforts being pursued on lands not managed by the United States Forest Service. However, gypsy moth suppression efforts on these other lands also carry the potential risks and benefits described for aquatic and riparian resources under Alternative 2.

Given this, cumulative effects associated with Alternative 2 would be expected to result in the following determinations for Regional Forester's sensitive fish species.

- candy darter (*Etheostoma osburni*) - may impact individuals but not likely to cause a trend to federal listing or a loss of viability
- New River shiner (*Notropis scabriceps*) - may impact individuals but not likely to cause a trend to federal listing or a loss of viability

Unavoidable Adverse Impacts

Based on the analysis above, any unavoidable impacts from *Btk* application to aquatic and riparian resources would likely be low in intensity and relatively brief in duration.

3.10.4. Irreversible or Irretrievable Commitment of Resources

It is expected that there would be no irreversible or irretrievable commitments of aquatic or riparian resources as a result of either of the alternatives analyzed in this report.

3.10.5. Consistency with the Forest Plan, Laws, Regulations, and Handbooks

The alternatives that were analyzed as described in this report are consistent with the Forest Plan, laws, regulations, and handbook direction pertaining to aquatic and riparian resources management.

4.0 CHAPTER 4 – PREPARERS, CONTACTS, AND LITERATURE CITED

4.1 Persons Who Prepared or Contributed to This EA

Interdisciplinary preparers and contributors to the 2009 Gypsy Moth Suppression Project include the following personnel.

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Federal Agencies

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USDI Fish & Wildlife Service, Elkins WV

State Agencies or Entities

Governor's Office of Economic & Community Development, Charleston WV
WV Department of Agriculture, Charleston WV
WV Division of Forestry, East Charleston WV
WV Division of Forestry, Marlinton WV
WV Division of Natural Resources, Elkins WV
WV Division of Natural Resources, Marlinton WV
WV Division of Natural Resources, Romney WV
WV Division of Natural Resources, White Sulphur Springs WV

County and Local Agencies

Greenbrier Chamber of Commerce, Lewisburg WV
Greenbrier County Planning Commission, Lewisburg WV
Marlinton Chamber of Commerce, Buckeye WV
Pocahontas County Commission, Marlinton WV

Organizations and Businesses

Allegheny Wood Products, Petersburg WV
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Beckwith Lumber Company, Inc., Slaty Fork WV
Blue Ribbon Coalition, Pocatello ID
Central Fiber, Canton OH
Columbia Gas Transmission, Elkins WV
Forest Watch, Morgantown WV
Georgia Pacific, Lewisburg WV
Greenbrier Valley Soil Conservation, Marlinton WV
Heartwood, Alton IL

Inter State Lumber Company, Bartow WV
Mountain State Sportsman Alliance, Lewisburg WV
National Wild Turkey Federation, Edgefield SC
The Nature Conservancy, Elkins WV
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Trout Unlimited, Westover WV
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WV Bear Hunters Association, Hillsboro WV
WV Coonhunters Association, Fairmont WV
WV Forestry Association, Ripley WV
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Media

The Register-Herald, Beckley WV
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The Inter-Mountain, Elkins, WV
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Comments/Potential Issues are categorized according to whether they are:

1. Comments beyond the scope of this project or non-responsive.
2. Resolved by Forest Service policy, other laws or regulations.
3. Addressed through Forest Plan Standards and Guidelines or Best Management Practices (BMPs).
4. Addressed through project design or mitigation measures.
5. Comments that can be addressed by developing alternatives to the proposed actions, measuring or analyzing the effects of different alternatives, and comparing or contrasting differences between alternatives.
6. Miscellaneous, for example: requests to be on mailing list; opinions in support of or against the project; specific questions.

Comment #	Project File Ref. #	Commenter Name	Affected Resource or Topic	Comment/Concern/Potential Issue	1	2	3	4	5	6	Response/Comments
1	Q-01	Amy Cimarolli, The Nature Conservancy	Pesticide effects on resources	I support the decision to use Gypchek on spray Units 22 and 28 since they are closest to mapped shale barrens. The rare Appalachian grizzled skipper utilizes plants that occur on shale barrens and other dry openings. I recommend consulting with an expert like Tom Allen on rare and common butterfly populations in or near spray areas on Allegheny Mountain, especially the southern units underlain with shale geology (i.e., 21, 37, 2, 18, 26) to determine if the use of *Btk* would be inappropriate.				X			We have switched to Gypchek in Unit 21, and Unit 37 has been dropped. After internal and external review, grizzled skipper was not known to occur within the other units, which are not underlain by shale. We contacted Tom Allen and he told us the skipper is usually in the adult life stage during the last two weeks of April through mid May. This period is when *Btk* applications would most likely occur to control early stages of gypsy moth larvae. *Btk* affects only the caterpillar stage of moths and butterflies, not adults and has residual activity from about 2-10 days. If the skipper is present within the proposed treatment areas of concern, *Btk* treatments would most likely occur during the adult life stage and *Btk* would not be present on foliage by the time skipper eggs hatch and larvae start to feed.

Comment #	Project File Ref. #	Commenter Name	Affected Resource or Topic	Comment/Concern/Potential Issue	1	2	3	4	5	6	Response/Comments
2	Q-02	Ray Knotts WV-DNR	Supports Project	The WV–DNR supports the USFS in it objectives for the proposed 2009 gypsy moth project.						X	Thanks for the support.
3	Q-03	Ray Knotts WV-DNR	Pesticide use preference	WV-DNR supports the decision to use Gypchek on spray Units 22 & 28. DNR also recommends the use of Gypchek on Units 21 and 37 to avoid impacting the rare Appalachian grizzled skipper. DNR also recommends including Unit 19 in the spray project to be treated with Gypchek because of severe defoliation experienced in 2008.				X			We will use Gypchek instead of *Btk* on Unit 21. Unit 37 has been dropped from the project because the adjacent private landowner at the last minute decided not to treat under the WVDA cooperative gypsy moth suppression program. Unit 19 was ranked as "medium priority" for resource values because of its proximity to private land. Because the adjacent landowner did not sign up to be included in the state suppression program, the area was not surveyed and included in the MNF gypsy moth project.
4	Q-04	Ray Knotts, WV-DNR	Suggest for timber thinning	WV-DNR suggests that the USFS consider thinning some overstocked stands prior to gypsy moth infestations and defoliation. This would be beneficial to younger overstocked stands which are more highly stressed by defoliation as opposed to trees with larger, more broad and dense crowns.	X						Thinning, at this point in time, would not reduce the effects of gypsy moth defoliation. The optimum time to thin overstocked oak stands to prepare for the effects of defoliation is approximately 3-5 years prior to their arrival. The USFS is planning on some timber stand improvement (TSI) activities in the future to improve the growth and health of younger stands in the general area. These TSI projects will focus on releasing oak, hickory, and other species valuable for wildlife and timber. However, it is not expected the TSI activities will increase the resistance of preferred oak species from the effects of recent gypsy moth defoliation. However, TSI activities could help reduce stress in stands that are exposed to future defoliation.